WE MUST FACE THE SOIL EROSION PROBLEM

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Other than low commodity prices, soil erosion is one of the most serious problems facing agriculture today. Unfortunately, many people, including scientists, do not feel that erosion of the soil resource by wind and water is a particularly pressing problem.

For example, a Nobel Prize winner was recently quoted in a news article as stating that "claims of excessive soil erosion across the nation have been overblown and much of it would occur regardless of how farmers grow their crops."

The author of a recent article published by the American Society of Agronomy stated that "the process (of erosion) has been slowed down or even halted in most of Europe, Canada, United States, Australia, South Africa, South Korea, the Soviet Union, China, Chile and a few other countries."

The skeptical need only fly over any area where intensive agriculture is practiced to realize that the erosion problem has not been halted in the U.S. Data compiled by USDA indicate that 94 million acres of cropland, or 25 percent of the total, is losing topsoil greater than the average permissable loss (generally 5 tons per acre per year), and 50 percent of the cropland in the U.S. needs some kind of conservation treatment.

In North Dakota, 4.4 million acres of cropland is losing more than 5 tons per acre per year. Depending on the county, 40 to 70 percent of the cropland needs soil conserving practices.

The problem of erosion is real, it is serious, and it needs immediate attention.

The total soil loss for North Dakota would amount to over 100 million tons per year. Assuming typical soil analysis and current fertilizer prices, the value of this soil loss just in terms of soil nutrients lost is over $500 million per year. The cost of replacing soil nutrients lost in the U.S. every year would amount to about $24 billion per year.

These dollar losses are staggering, and it has been said that a farmer looks at soil conservation from a business perspective. If only economic factors were considered, however, it is not likely we would see even the current level of soil conservation practices or interest in conservation tillage. The progress that has been made in the voluntary soil conservation program over the past 40 years is surely related to a land stewardship ethic. Financial incentives have contributed but are probably not the driving force for many of those participating in conservation programs.

Many biological systems have the capacity to regenerate after substantial change has taken place. Most soil systems differ in that they develop their characteristics over thousands of years. The average soil in North Dakota may be 15,000 years old. Removal of productive surface soils which expose unfavorable subsurface materials is therefore a permanent change from the standpoint of our civilization. We need to think of soil systems as nonrenewable resources.

Research data on relationships between erosion and crop yields are limited, but investigations usually show severe reductions where erosion has removed the productive surface materials and exposed unfavorable subsurface conditions. Some unfavorable subsurface conditions include: high clay content, sand or gravel layers, highly acid or alkaline conditions, low nutrient content, low water infiltration capacity, low water-holding capacity, coarse fragments, poor tilth, high salt content or bedrock. Yields on severely eroded soils are commonly 30 to 40 percent lower as compared to soils with only slight erosion.

Erosion problems and productivity losses are largely related to the quality of land and how the land is used. For example, when wheat acreage in North Dakota hit 12 million acres, there were more soil erosion problems, because marginal land that should not have been cultivated was seeded to wheat. If all cropland was Class I land, with deep soils, good drainage and gentle slopes, there would probably be little or no problem with soil erosion. However, North Dakota has almost no Class I land. There are many different landscapes, and each has its unique soil erosion problems and conservation needs.

Conservation tillage is one method of reducing soil erosion by water and wind. Acreage of conservation tillage is increasing rapidly. However, this practice is a major modification in cropping systems and it is important to study its effects on the soil system and plant environment.

Damage to cropland, and dramatically reduced productivity, from wind erosion is obvious from the air.

Soil scientist Dr. Edward J. Deibert of NDSU says that intensive tillage practices over the past 50 years have virtually destroyed many of the good physical conditions that were found under native sod, creating many of the soil erosion and management problems experienced today. Reduced tillage or no-till systems give producers another soil management option, he says, but an understanding of the changes that occur under reduced tillage is essential to make proper soil management recommendations.

The Department of Soil Science and branch stations have been conducting a number of long term cooperative tillage trials since 1977. Soil properties are being monitored in studies that compare conventional with reduced tillage planting systems under various crop rotations.

There is some concern that reduced tillage, which leaves more residue on the surface and creates wetter conditions, will decrease the soil temperature and cause management problems such as delayed planting, slow emergence and increased use of starter fertilizer. Results so far show these concerns are not always justified. Mean soil temperatures are not always lower with reduced tillage and vary from year to year depending on air temperature cycles and the distribution and amount of residue.

Soil moisture is one of the most limiting factors for crop production in North Dakota. Conventional farming methods with excessive tillage do not make efficient use of moisture because runoff and evaporation are increased.

Tillage trials indicate that 50 to 60 percent of the nongrowing precipitation can be stored in the soil with residue left standing over winter. In western North Dakota, 2 to 3 inches more moisture was stored in the soil profile where residue was left standing. No-till and reduced tillage systems in the Red River Valley gained 1 to 2 inches of moisture over conventional fall plow systems which included secondary tillage. This stored soil moisture made a significant difference in crop yields during the dry years of 1980 and 1982.

A knowledge of the degree of aggregation of any soil is an important factor in soil management because this property determines soil structure or tilth. Soils containing a large portion of stable aggregates resist breakdown from tillage operations and allow for movement of water into the soil profile. Porosity of the soil also increases with aggregation, which provides a more favorable environment for plant root growth and microbial activity. The switch to reduced tillage or no-till has provided the opportunity for improving the aggregation or structure of our soils. Continued use of some type of reduced tillage will enhance soil aggregation and improve soil structure to a point where many of the soil management problems encountered today will be eliminated.

Says Deibert, "The long term results of no-till and reduced tillage planting systems on soil physical properties are just beginning to be realized. The improvements in soil aggregation and increased infiltration with residue cover and associated influence on erosion reductions by these systems cannot be overemphasized."

It is apparent that continued and expanded research efforts on soil erosion and cropping systems are needed. There is a need to develop a statewide coordinated effort in these conservation research areas, as scientists in many different departments and agencies need to work cooperatively to fully answer the questions. Erosion research emphasis will probably involve scientists from agricultural economics, agricultural engineering, botany, and soil science, with major support from the Land Reclamation Research Center and the branch experiment stations. Cropping systems research would include these same agricultural disciplines as well as agronomy, bacteriology, and plant pathology. In addition, the Soil Conservation Service, Agricultural Research Service, U.S. Geological Survey, North Dakota Mining and Mineral Resources Research Institute, the University of North Dakota Geology Department and North Dakota Soil Conservation Districts would be involved in portions of these programs.

Many units are involved in erosion and cropping systems research. What is needed is a comprehensive statewide plan to coordinate this research activity.

Although values for total erosion in North Dakota are available, additional research needs to be conducted on determining erosion losses on specific landscapes and the impact of erosion on productivity. Some areas in the state are particularly fragile or sensitive to erosion. These areas must be identified and measures for erosion control developed.

At present, little research is being conducted on the basic mechanics of water and wind erosion in North Dakota. Research is needed to determine the mechanisms involved in the structural breakdown that permits wind erosion of the clay soils in the Red River Valley. Evaluation of the relative importance of wind and water erosion in North Dakota is needed. Information is needed on the erosivity (K factor) of major soils in North Dakota. Erosion losses should be evaluated for landscapes in alternate crop-fallow, range, reclaimed areas and for various small grain and row crops.

A major emphasis of proposed research is associated with conservation tillage. Although research is presently being conducted in conservation tillage, additional emphasis is needed on eroded areas and more researchers are needed to study the impact of conservation tillage on our cropping systems. Innovative management systems that minimize erosion losses in crop and range lands also need to be developed.

The erosion problem is real and needs the immediate attention of scientists, farmers, ranchers, politicians and all involved in natural resource management. Conservation efforts in the U.S. have been criticized, but there is still an opportunity for successful efforts in soil conservation. The increase in conservation tillage in recent years is a good example of progress in controlling erosion, but additional research and coordination of efforts is essential to meet this vital challenge.