Wind Erosion Control on Organic Soils

Michigan State University Extension Service
L.S. Robertson, Crop and Soil Sciences; H. C. Price, Horticulture; D. D. Warncke, D. L. Mokma, Crop and Soil Sciences

Issued December 1978
6 pages

Fig. 1. Tree windbreaks used on sod farm in Lapeer County. (Photo courtesy USDA Soil Conservation Service.)

Methods for controlling wind erosion on organic soils include:

1. Using irrigation water to keep surface soil moist
2. Regulating water table height
3. Tree windbreaks
4. Shrub windbreaks
5. Grass windbreaks
6. Long, narrow fields perpendicular to prevailing winds
7. Tillage direction at right angles to prevailing winds
8. Ridging
9. Crops planted perpendicular to prevailing winds
10. Strip-cropping at right angles to prevailing winds
11. Primary tillage immediately before planting
12. Spring minimum tillage methods
13. No-till methods
14. Single sweep shovel on cultivator
15. Fall-planted cover crops
16. Rolling to firm surface soil
17. Snow fences

by L. S. Robertson, H. C. Price, D. D. Warncke and D. L. Mokma[2]

Wind Erosion — A Major Problem On Organic Soil

The term organic soil refers to any soil containing a high percentage of organic matter in the plow layer. More specifically, the organic materials should represent more than 20% of the soil material and exceed 12 inches in depth.

Wind has destroyed many acres of organic soil in Michigan. As a result, some farmers now operate on sand or low grade marl. Soil losses from wind erosion under such circumstances are sometimes staggering. The Soil Erodibility Index (I) of the Wind Erosion Equation, E=f(IKCLV), as used by the Soil Conservation Service for such soil material is about 10 tons per acre annually (Wind Erodibility Group 2).

Wind erosion has always been a major problem on lightweight organic soils and will continue unless crop production methods change. If soil is dry and unprotected, even relatively low wind velocities cause soil movement; erosion can become serious when wind velocities are above average for an extended time.

The crop producer is hurt most by erosion because crop yields are reduced when crops are cut off, buried or blown out; ditches filled with organic debris; and soil depth reduced so that field tile do not drain properly.

1 The authors appreciate the assistance of Dwight L. Quisenberry, SCS, USDA; Robert J. VanKlompenberg, Ottawa County Extension Agent; Carter M. Harrison and Robert L. Lucas, Professors Emeritus, Crop and Soil Sciences Department; in preparing this bulletin.

2 The authors are, respectively, Professor Crop and Soil Sciences Department; Associate Professor, Horticulture Department; and Assistant Professors, Crop and Soil Sciences Department.

You can't stop th

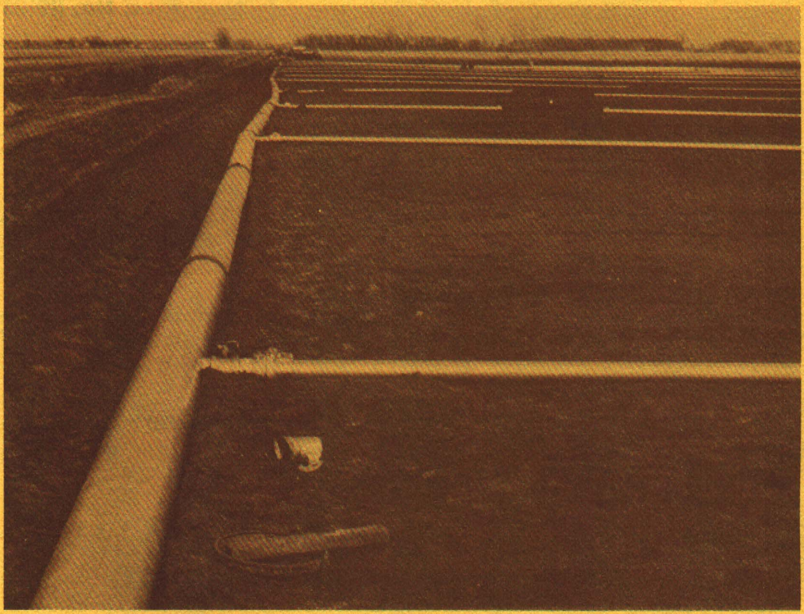


Fig. 2. Installing solid set irrigation pipe after planting carrots to reduce soil losses. Water should be applied before the surface soil dries and before the wind blows.

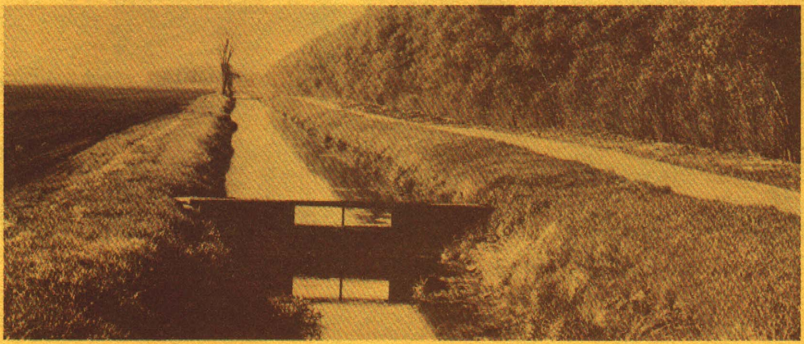


Fig. 3. Dams in ditches help regulate water table depths. High water tables should be maintained during winter months and in spring until field work starts.

Fig. 4. Research on windbreak shrub density with different management practices provides valuable information on wind erosion control.

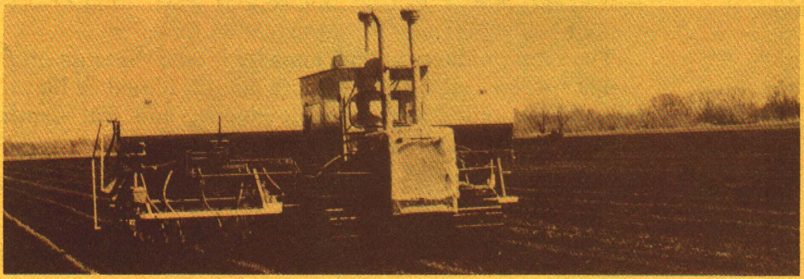


Fig. 5. Planting onions between grass (rye) strips. Fall-seeded rye provides better protection than spring-planted grasses.

he wind, but you can reduce erosion with

Wind Erosion Problems Are Increasing

Generally, wind erosion problems on organic soils are increasing because:

1) Field and farm sizes are increasing due to economic conditions and farm implement size and efficiency.

2) Tree windbreaks have been removed or are aging. Old trees have few branches near ground level and, therefore, are less effective. When a tree dies, wind funnels through the gap causing a problem.

3) Permanent windbreak plantings are decreasing because many farmers cannot afford to donate the space for such vegetation on expensive organic soils. Other farmers sometimes experience frost damage in the lee of the windbreak, roots in tile lines and debris from the windbreaks blown onto the field.

4) Tile and ditch drainage is essential for crop production on organic soils, but this lowers the water table resulting in drier soil and increasing the chance for wind erosion.

5) Effective herbicide programs have greatly reduced weed problems on many farms, but they have eliminated nature's way of protecting soil against wind erosion.

6) Intensive vegetable production usually leaves few crop residues to protect soil.

7) There is insufficient advanced planning on the proper use of cover crops, annual windbreaks, small grain rows, etc.

Wind Erosion Control Practices

The first step in wind erosion control is to obtain a soil and water conservation plan. The plan contains: maps showing the location and boundaries of different soils, a description of each soil, and a listing of crop production problems and hazards, including wind erosion.

If not already a member of the local soil conservation district, enroll now and take advantage of the technical assistance and knowledge available through the district and from the Soil Conservation Service. A complete soil and water conservation plan for your farm is available at no cost from your local soil conservation district office if you are a member.

Effective wind erosion control practices for organic soils include:

1. *Using irrigation water to keep soil moist.* Moist soils are not easily blown. Apply water from solid set systems before the surface soil dries and before the wind blows. Other systems are not well suited for this purpose.

Some producers regularly monitor the National Oceanic and Atmospheric Administration (NOAA) weather radio and when wind velocities are predicted to exceed 20 miles per hour, solid set irrigation systems are activated. Of all the farmers in the state, those using this system seem to have fewer wind erosion problems. Call your nearest weather station for more information on NOAA.

2. *Regulating water table height.* The ideal water control system on organic soil permits a progressive and controlled lowering of the water table in the growing season. Maintain a high water table until just before spring field operations. Where possible, lower water tables in the same sequence that fields are worked.

3. *Tree windbreaks.* This long-time wind control method has not recently been used extensively. Hardy evergreen trees on farm boundaries provide maximum year-round protection while the old-fashioned deciduous trees lose some effectiveness in the fall after their leaves drop or as they mature.

Windbreaks should generally be 2 rows planted at right angles to the prevailing winds. Protection from wind is effective over an area about 10 times the tree height. Exercise care in choosing a species because some trees are better suited than others on specific soils. Also, roots can clog tile if the wrong species is planted or if planting is made in the wrong location. Some county offices of the Cooperative Extension Service and the local Soil Conservation District can provide information on planting location, spacings and species, as well as a good source of planting stock.

While trees effectively reduce wind erosion, some vegetable producers report that in calm weather, especially with irrigation, there is a crop disease hazard when vegetation dries slowly. Also, without air movement, frost hazards increase on surfaces of dry soil.

4. *Shrub windbreaks.* Using shrubs, such as spirea, instead of trees appeals to some vegetable producers because they need less land surface. Also, some species grow faster than trees, but do not get as tall. Therefore, the protected areas are not as wide and more windbreaks are required. All comments made on tree windbreaks apply to shrubs.

5. *Grass windbreaks (vegetative barriers, herbaceous barriers).* There are two kinds of grass windbreaks. However, no data are available on perennial grass windbreaks for Michigan's organic soils. Recent and very limited observations by the Soil Conservation Service indicate that Tall Wheatgrass grown in double rows is a possibility. On sandy soils this species averages about 3 feet tall, with some attaining almost 5 feet.

Small grains, the second kind of grass windbreak, are planted in single or double rows and sometimes in drill widths. Spring-planted small grains are much less effective than fall-planted but are better than nothing. Spring plantings result in complete soil exposure during the winter when much erosion occurs. Fall-seeded rye is most effective. Some farmers have made special cutting devices to

these measures:

Fig. 6. Growth of fall-planted rye strips must be regulated in late spring. These were clipped with a rotary mower to keep height at about 8 in.

Fig. 7. Oat cover crop that froze in the fall provides a protective mat during the winter and spring when erosion hazards are greatest.

Fig. 8. This field was subsoiled to 24 in. in the fall and moldboard plowed to 12 in. in the spring. Planting and installation of irrigation pipe were done in one day. The ridges in this field are effective barriers when supplemented with irrigation water.

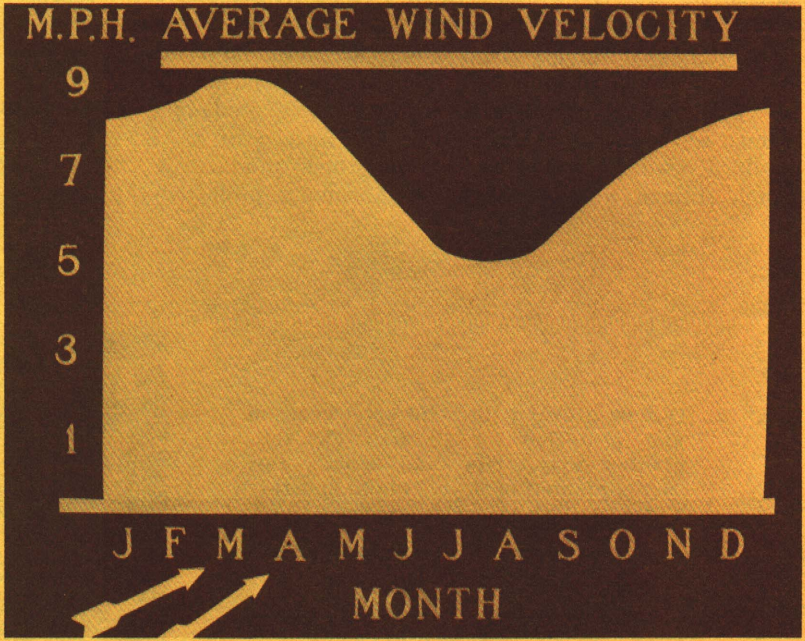


Fig. 9. Wind erosion potentials in Michigan are greatest in the winter and early spring.

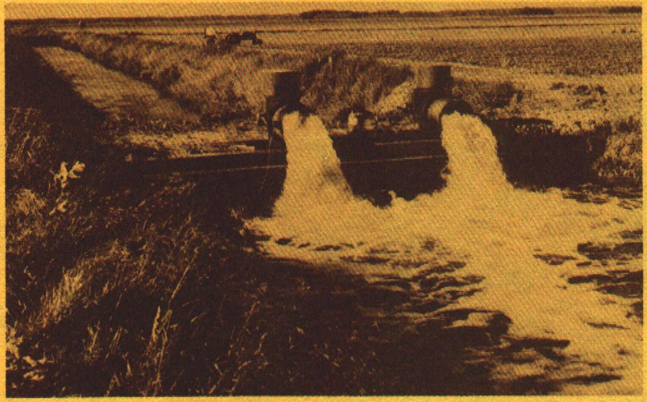


Fig. 10. Pumping station helps to control level of water table.

Fig. 11. Promising Michigan research with no-till methods involves the use of fall-seeded grasses and chemicals to kill them in the spring. Details on planter design and approval of effective herbicides still need to be worked out.

delay heading and cultivators to destroy such rows once the danger of wind erosion passes.

On some farms, the entire field is planted to rye and strips are left when plowing in the spring. The width of the strip for vegetable production is carefully measured to accommodate tillage, planting and harvesting equipment. Rye strips should be 7 or more feet wide, while the cultivated strips vary depending on the Wind Erodibility Group to which the soil belongs. Most soils require widths less than 70 feet.

Where rye is left for seed, match the width of the strip with the width of the combine cutterbar. Some farmers use strips of fall-planted rye and single rows of spring-seeded small grain between each vegetable row. This is relatively effective when used in combination with other soil conservation practices.

6. *Long, narrow fields perpendicular to prevailing winds.* Use this method in conjunction with other conservation practices. It is not a perfect solution because on occasion the wind blows at 90° from the direction of prevailing winds. In addition, tillage, planting and harvest directions in long, narrow fields are regulated by field shape.

7. *Tillage directions at right angles to prevailing winds.* Most tillage implements create ridges which, when the wind blows at right angles, reduce soil movement by *saltation* (a movement where soil particles bounce 1 or 2 feet into the air and then back to hit the soil's surface) and by *surface creep.* This method is relatively ineffective when wind blows at high velocities for extended periods.

8. *Ridging.* Ridging is an important consideration as indicated by the letter K (soil ridge roughness factor) in the wind erosion equation, E=f(IKCLV), in predicting annual soil losses. Fields with a smooth surface are most easily eroded. Therefore, anything which produces a rough surface will be beneficial. Maximum protection occurs when surface soil is ridged with tillage, planting and cultivating equipment perpendicular to prevailing winds. Ridges are easily leveled off by wind and are effective for only short periods unless they are rebuilt.

9. *Crops planted perpendicular to prevailing winds.* Anything that slows down the wind velocity on soil surface is beneficial. Individual as well as rows of plants act as windbreaks. Ridges created at planting or cultivation reduce areas of high wind-soil contact. Multiple rows such as some producers now use in place of single rows reduce wind erosion problems.

10. *Strip-cropping perpendicular to prevailing winds.* Alternate strips of equal width of vegetable crops with small grains or corn. Maximum width is determined by kind of crop and size of tillage, planting and harvesting equipment.

11. *Primary tillage immediately before planting.* The best moisture level for tillage is also the best for planting, so ideally, tillage and planting should be done in the same operation or on the same day. Organic soils dry rapidly after tillage and erosion potentials increase.

12. *Spring minimum tillage methods.* Minimum tillage is the least tillage necessary for rapid seed germination, a good stand and high yields. Where root crops are grown on organic soils, the definition is expanded to include the production of well-shaped roots. Minimum tillage is especially important on organic soils containing relatively large amounts of mineral material, especially marl. The larger the soil aggregate, the more it weighs and the less likely it will be moved by the wind. Residues from previous crops are effective if present in sufficient quantity.

13. *No-till methods.* No-till planting in a full stand of fall-planted rye represents a theoretically wind-proof environment. Unfortunately, details of planter design and approved herbicides have not been worked out. Methods for obtaining rapid seed germination, uniform

Fig. 12. Onions grown with solid set irrigation and protected by 10 ft. wide fall-planted rye strips and single row spring-planted barley. (Photo courtesy USDA Soil Conservation Service.)

stands and uniform root shape and sizes need to be researched. Uniform planting depth of small-seeded crops and adequate seed-soil contact, even where rotary strip tillage was used, have been difficult to obtain. Nevertheless, this method of wind erosion control may be used extensively for many crops, including root crops, in the future.

14. *Single sweep shovel on cultivator.* A single sweep shovel produces excellent weed control between the rows while producing relatively large soil aggregates not easily moved by wind. In addition, small ridges form to effectively reduce wind action.

15. *Fall-planted cover crops.* Fall-planted cover crops protect the soil during the critical winter and spring months. Rye, ryegrass, wheat, oats, barley and buckwheat have all been effective, providing that good fall growth is obtained. For crops such as oats that freeze during the winter, residues retard soil drying in the spring by reducing evaporation rates.

Incorporating cover crops into organic soil increases the fiber content, thus reducing wind erosion losses. Both cover and green manure crops improve aeration and soil structure when incorporated into older, finely divided organic soils. This is important in root crop production.

16. *Rolling to firm surface soil.* Rolling is sometimes beneficial on organic soil where large volumes of trash and crop residues have been plowed down and the soil is excessively loose and porous. Under these conditions, soil dries rapidly, increasing opportunities for wind erosion. A corrugated roller firms such soil, retarding the drying rate and, therefore, wind erosion susceptibility.

17. *Snow fences.* After planting a crop, some producers still use snow fences to protect the soil. These effectively reduce wind velocities, but labor and material are expensive. In the past when fields were small, crates and burlap fences set in the field served as similar control methods.

Planning For Wind Erosion Control

Wind erosion on organic soil is a perpetual problem — one requiring several practices for adequate control. Using only one of the methods described above is not likely to provide adequate control.

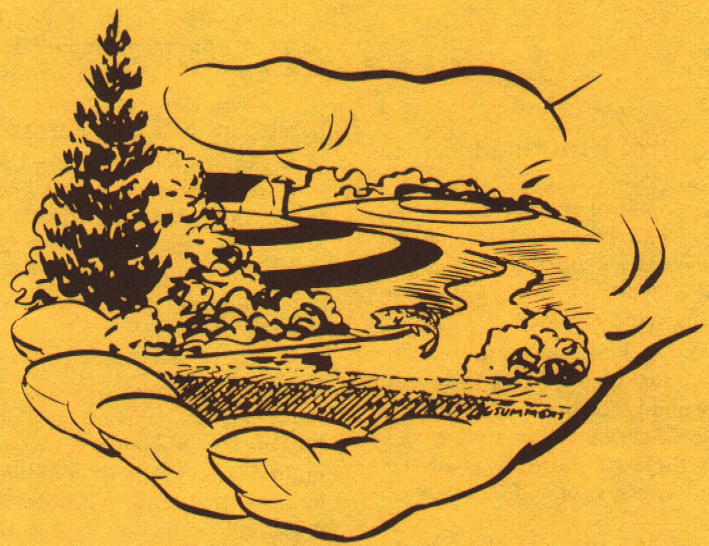
Obtain assistance in solving wind erosion problems from your County Cooperative Extension Service, from the United States Soil Conservation Service technicians who assist your Soil Conservation District, and from other farmers on organic soils — those who have successfully solved this problem on their farms.

While the general principles of wind erosion control on organic soils are well known, further study and research should provide new concepts.

Responsibility

Organic soils occur in every Michigan county, totaling nearly 4.5 million acres. Yet, only limited acres are suited for commercial crop production. Therefore, every individual working with organic soil is responsible for protecting this non-replaceable natural resource.

Michigan's organic soils started formation 10 to 17 thousand years ago, immediately after the retreat of the last glacier. It is estimated that it took 500 years to produce a foot of muck in some places. We are now losing some muck at the rate of one foot in 12 years due to the combined effect of *wind erosion*, oxidation, dehydration and crop harvesting. We can and must do a better job of protecting organic soils.



LEND A HELPING HAND
to
CONSERVATION OF LAND

Cooperative Extension Service Programs are open to all without regard to race, color, creed, or national origin. Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Gordon E. Guyer, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

1P-10M-12:78-HP. Price 20 cents.