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STRIPCROPPING FOR WIND EROSION CONTROL

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> **This is the forty-second of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.**

STRIPCROPPING, wind stripping, or strip farming, as it is variously called in different regions, is used to control wind erosion, especially in crop-fallow sequences in the Northern and Central Great Plains. It is a practice that does not require any change in cropping practices. It merely involves subdividing the farm into alternate strips of erosion-resistant and erosion-susceptible cropping practices. If the cropping practices on the farm are equally resistant or susceptible to wind erosion, there is no need for stripcropping.

Stripcropping is especially adaptable in dry regions where fallowing is done every second or third year. In the northern dry regions the summer-fallowed land is not seeded until the following spring. Thus, it is left bare during the windy season except for what crop residue may remain on the surface from a crop grown almost 2 years previously. To protect it from wind erosion, strips of standing stubble alternating with strips of fallow are virtually imperative on many soils. In the southern dry regions the problem is less acute because wheat on fallow is sown in the fall and if germination and growth conditions are favorable, a good protective cover against next spring's winds is usually obtained.

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The purpose of stripcropping for wind erosion control is to provide barriers or trap-strips to check the spread of soil movement if and when it starts. The most common barrier strips are standing wheat or sorghum stubble. The stubble should not be disturbed by tillage or pasturing until the danger of blowing is over. Wheat stubble is generally more effective than sorghum stubble, and standing stubble more effective than flattened stubble for trapping blown soil. The stubble should be left as thick and as tall as possible.

How effective is stripcropping for wind erosion control? The answer to this question hinges largely on how effective the system is in preventing the rate of soil movement from exceeding a certain tolerable limit. Measurements of with different soils and under different wind velocities and directions show that soil blowing is zero at the windward edge of a field or strip and increases with distance downwind until it reaches a maximum. The maximum rate of flow is remarkably uniform for all soils. For a 40-m.p.h. wind velocity, it is equal to about 2 tons per rod width per hour.

The more erodible the soil, the greater is the

A strip rotation of wheat, fallow, and sorghum on a highly erodible sandy soil. Strips are 20 feet wide.

rate of increase in soil flow along the direction of wind and the shorter the distance in which the possible maximum soil flow is reached. Soil erodibility and therefore the rate of increase in soil flow are influencd greatly by soil textural class. The intermediate-textured soils, such as loams, are generally least erodible and the rate of increase in soil flow is more gradual than on sandy soils or some clays. Therefore, to be equally effective, strips on sandy soils and on some clays have to be narrower than on intermediate-textured soils. Based on average results, widths of erosion-susceptible strips necessary to keep the rate of soil flow from exceeding .2 ton per rod width per hour should be as follows:

Soil class	Width of strips
Sand	1.2 rods
Loamy sand	1.6 "
Sandy loam	6 "
Loam	15 "
Silt loam	17 "
Clay loam	21 "
Silty clay loam	26 "
Silty clay	9 "
Clay (subject to granulation)	5 "

The above widths are applicable for strips protected by 1-foot high stubble on the windward side and running at right angles to the wind of a velocity of 40 miles per hour. The widths should be adjusted one way or the other to fit the width of tillage machinery and to divide equally into the whole area to be stripped.

The actual width of strips required is influenced by several major factors. Apart from soil textural class, the general level of wind velocity plays a major part. The higher the likely wind velocity, the narrower the strips should be for equal effectiveness. Also, the effectiveness of the strips decreases as the wind deviates from right angles to the strips.

Still another factor is the width of the barrier strips and the height and thickness of stubble or other plant material in the barrier strips. The primary purpose of the barrier strips is to trap the soil that blows off the erosion-susceptible strips. There is some sheltering afforded by the barrier strips, but measurements have shown that for all but the most erodible soils the distance sheltered by standing stubble is small compared to the distance required for soil flow to reach the maximum rate.

For example, complete protection afforded by 1-foot high wheat stubble extends from 5 to 20 feet along the direction of the wind; but, the distance required for soil flow to reach a maximum rate ranges from about 100 to 10,000 feet, depending on wind velocity and soil erodibility. In other words, the increase in soil flow is not

Contour stripcropping with terraces on a western Kansas field.

Aerial view of the Arneberg dairy farm showing the .5-acre irrigation pond in right middle-distance.

primarily due to reduction in sheltering afforded by the barrier strips. It is due mainly to a phenomenon known as soil avalanching, which is much like snow gathering volume and momentum as it rolls down a mountain.

The barrier strips need to be only wide and receptive enough to trap all the soil, except fine dust, that moves into them. For standing wheat stubble, a 30- to 50-foot width is usually sufficient. However, the erosion-resistant strips are usually rotated each year with erosion-susceptible strips so that both are normally made equal in width. The width of erosion-resistant strips in such cases is usually far greater than that required to trap all soil that may be moved into them.

The width of strips depends, too, on the rate of soil movement that may be considered tolerable. This in turn, depends on how much reduction in erosion is desired. The greater the desired reduction, the narrower the strips should be. The rate of .2 ton per rod width per hour may be considered tolerable. It is not a negligible rate. It is the rate that should occur on the leeward side of strips under a 40-m.p.h. wind velocity without supplementary practices of erosion control. Supplementary practices that maintain crop residues above the surface of the ground and increase surface roughness and soil cloddiness would normally reduce erosion to a negligible rate. If, in unusually dry years, crops fail and insufficient crop residues, surface roughness, and soil cloddiness are available for needed protection, the maximum rate of erosion in a stripcropping system should be only .2 ton per rod width per hour—about one-tenth of the possible maximum rate of soil erosion.

The tolerable rate of soil flow is associated with the degree of risk the farmer is willing to take. He has to accept the width of strips that would fail occasionally because the width that would reduce erosion to a negligible degree without the presence of sufficient amounts of crop residue, surface roughness, and soil cloddiness would be too narrow to be practical for most soils.

Space is too limited in an article of this type to indicate the intricate relationships between suitable width of strips required for different conditions. Formulas indicating suitable width of strips for virtually any soil class, height of wind barrier in the erosion resistant strips, wind velocity and direction, and tolerable rate of erosion likely to occur on erosion-susceptible strips are given in the Kansas Agricultural Experiment Station Technical Bulletin 92, 1957.

A strip rotation of wheat, sorghum, and fallow on a sandy loam soil, with strips about 75 feet wide.

Stripcropping at best may reduce the intensity of wind erosion, but not stop it. Alone it has never been sufficient, but merely an aid, in reducing erosion, and especially in preventing soil blowing from spreading to other farms and communities.

Some special precautions must be taken in stripcropping systems. The tendency of soil to ridge on the windward edge of the stubble strips is one objectionable feature. To overcome this tendency the edges of the stubble strips may be disked so the blown soil would be spread over the stubble instead of ridging on the edge. Under extremely erosive conditions, strips may be shifted slightly to one side each year.

Another problem may be weeds growing on the edges of strips. These can be controlled by seeding grain 2 or 3 feet over into the next strip. As the next strip is cultivated later in the season, the cultivator can be extended into the seeded strip, thus killing the weeds that may grow along the edge.

Still another difficulty of stripcropping has been grasshopper and other insect infestations along the edges of wheat adjoining the sorghum or wheat stubble strips. With the advent of modern insecticides and modern spraying techniques, this problem usually can be overcome readily. Information on the use of modern insecticides can be obtained from various entomological institutions.

Some inconveniences of stripcropping are time lost in moving equipment from one strip to another, roads required along headlands to work strips, impossibility of cross-cultivation, and inconvenience of pasturing sorghum strips in the fall and the alternating wheat strips in the spring. Where extremely large tillage and planting equipment is used, farmers seldom like to practice stripcropping; but, with ordinary equipment there is little complaint.

Under severe conditions of wind erosion many farmers who have adopted the system are convinced that the advantages of stripcropping far outweigh the disadvantages, provided, of course, supplementary practices that must go with stripcropping are adopted too.