Emergency Wind Erosion Control

February through May is the critical time for wind erosion in Kansas, but wind erosion can happen any time when high winds occur on smooth, wide fields with low vegetation and poor soil structure. The loss of soil through blowing dust dramatically decreases the productivity of soils (Li et al., 2007). Dust contains the majority of soil organic matter and fine particulates that allow soils to hold water and nutrients. Dust also can have significant economic, human and animal health, and safety impacts.

The most effective wind erosion control is to ensure a protective cover of residue or growing crop throughout the critical erosion period. Control measures such as strip cropping, residue management, reduced tillage, grass strips, and windbreaks are effective management methods for reducing erosion because they increase the surface roughness or reduce surface wind speeds. However, these prevention methods must be planned at least a season in advance.

Under some conditions, cropland can be quite susceptible to wind erosion. Burning or removing crop residues for forage creates a particularly serious hazard. Winter wheat and other fall-planted crop fields also may be susceptible during periods of low cover in the winter and early spring. This is particularly true after a drought year or after other crop failures. Marginally productive cropland may not produce sufficient residue to provide protection from wind erosion. In addition, overgrazed or poorly vegetated rangeland may be subject to wind erosion.

It is important to monitor field conditions and identify fields with conditions susceptible to erosion. These conditions include low vegetative cover and a high proportion of erodible-sized clods (less than 1 millimeter, or about the thickness of a dime). Treating potential problems before they occur is preferred to reacting after a field is actively eroding. Once soil movement has started, it is difficult to avoid further damage. Prompt action, however, may prevent a small erodible spot from damaging an entire field or adjacent fields.

Legal Aspects

Kansas law (Kan. Stat. Ann. §2-2001 through 2-2009) addresses wind erosion control. If soil is blowing off any property in quantities large enough to cause erosion damage, damage on land downwind, or injury to the public health, soil blowing must be lessened or stopped. If the landowner cannot or will not stop wind erosion in a timely manner, county commissioners are authorized to have emergency wind erosion control performed (Kan. Stat. Ann. §2-2004). County commissioners can create a soil-drifting fund from which costs of erosion control can be paid. To create the fund, the county commissioners can levy a tax against all taxable tangible personal property of the county. (Kan. Stat. Ann. §2-2007).

Alternatively, the commissioners, after notice and a hearing, can recover the cost of any emergency tillage by levying a special assessment against the land.

Figure 1. *Emergency tillage across 50 percent of the field (Photo credit: USDA-ARS Engineering & Wind Erosion Research Unit).*

Figure 2. *Tillage implement with very wide spaced shanks, making clods to roughen the soil surface. (Photo credit: John Smith, University of Nebraska).*

The special assessment is not to exceed $3 per acre for each acre on which work is done for any one year, unless such amount is not adequate to cover the actual cost of the work (Kan. Stat. Ann. §2-2008 (b))

Emergency Control

Mulching

If wind erosion has started, it can be reduced by mulching with manure or other anchored plant materials such as straw or hay. To be effective, at least 1.5 to 2 tons per acre of straw or grass or 3 to 4 tons per acre of corn or sorghum stover are needed to control areas of erosion. Residue can be spread by hand, spreader, or other mechanical equipment. A stubble puncher or disk set straight may be used to anchor residue and prevent it from being blown away.

Wet manure application should be 15 to 20 tons per acre and not incorporated into the soil.

Care should be taken to not add wheel paths parallel to the wind direction as the mulch is applied. Traffic areas and wheel paths can contribute to wind erosion.

Generally, mulches are only practical for small areas, so mulching is most effective when applied before the soil starts to move. Producers should scout fields to identify areas that might be susceptible to wind erosion if they plan to use mulch or manure as a control. Signs to look for include low residue quantity, or residue that is broken off from the plant.

Emergency Tillage Basics

Emergency tillage is a last resort that can be effective if done promptly with the right equipment. The goal of emergency tillage is to make the soil surface rougher by producing resistant clods and surface ridges. A rough surface reduces wind speed. The larger clods and ridges resist movement and provide traps to catch moving soil particles.

Chisels with single or few tool ranks are frequently used to roughen the soil surface. For emergency tillage, the chisel point and speed and depth of operation combination that produces the roughest surface with the largest number of firm clods resistant to falling apart when dry, should be used. Finding the right combination might take some experimentation. The depth of tillage usually affects clod stability more than travel speed, but optimum depth is highly dependent on soil conditions (i.e., moisture) and compaction. Deeper tillage passes often can produce more resistant clods than shallow passes.

Tips for Effective Emergency Tillage

1. Watch the weather forecast for periods of high winds (greater than 25 miles per hour), particularly when surface soils are dry.
2. Assess residue and plant cover before the wind begins blowing, and take preventive action with emergency tillage. It is much easier to prevent the problem from starting than to stop erosion after it begins. If you wait, the soil only gets drier, losing moisture needed to form clods.
3. Use the combination of tractor speed, tillage depth, and shovel size that produces the roughest surface with the most resistant clods. If wind erosion is anticipated, do some test tillage beforehand to see what tillage tool, depth, and speed provides adequate clods and surface roughness.
4. Always start at the upwind location when the field is blowing. A sufficient area upwind of the eroding spot should be tilled in addition to the area presently blowing.
5. Till in a direction perpendicular to the prevailing wind direction (Table 1). For row crop areas, it may be necessary to compromise direction and follow the row pattern. Maintain as much anchored stubble in the field as possible.

Emergency Tillage: Sandy Soils

Loose sandy soils require a different tillage approach to effectively control erosion. On sandy soils, clods cannot be formed that will be sufficiently resistant to erosion. Erosion resistance is achieve through building ridges and furrows in the field to provide adequate protection. A 14-inch moldboard lister spaced 40 to 50 inches apart (or an 8-inch lister on 20- to 24-inch spacings) is needed to create sufficient surface roughness. The first listing pass should be shallow, not more than about 4 to 5 inches deep. Then, when additional treatment is needed, the depth should become progressively deeper. Alternatively, for the second treatment the original ridge may be split. The addition of manure to the ridged surface may be beneficial.

Emergency Tillage on Soils and Residues: Spacing Strategies

Performing emergency, clod-forming tillage across the field is effective. Tillage passes should be made perpendicular to the direction of the prevailing wind causing the erosion (Table 1).The success of emergency tillage is highly dependent on climatic, soil, and cover conditions. There are different tried-and-true strategies that can be used for the different soil types.

Clayey soils: Research shows a narrow chisel (2 inches wide) on 24- to 54-inch spacings and operated at 3- to 6-inch depths usually bring sufficient resistant clods to the surface to control erosion on fine-textured soils (clayey soils).

Loamy soils: A medium, 4-inch wide shovel can be effective for medium-textured soils (loamy soils). Narrower spacings should be used where there is no cover and wider in areas of partial cover, such as in growing crops or plant residue. If the erosion conditions recur or persist, a second, deeper chiseling should split the first spacing. For example, if the first chiseling was done on 24-inch spacings and clod-forming tillage was necessary to keep the field from blowing, the second tillage pass should happen in such a way that the implement is operated in the same direction as the first tillage, but the shanks should be run 12 inches over from the previous pass.

Figure 3. *A field in southwestern Kansas with major wind erosion damage. (Photo credit: DeAnn Presley)*

Emergency Tillage — Alternating Passes

It is often not necessary to till the entire field, but rather, it is effective to perform emergency tillage passes across 50 percent of the field (till a pass, skip a pass, repeat). A narrow chisel spacing (20 to 24 inches) is best for this method. If 50 percent of the area has been tilled and wind erosion persists, the omitted strips can be emergency tilled in a second operation to make tillage full cover. If a second tillage pass is needed, it should be at a greater depth than the first pass. Wide chisel spacings are used in the full-field coverage method. The space between chisel grooves can be chiseled later should wind persist.

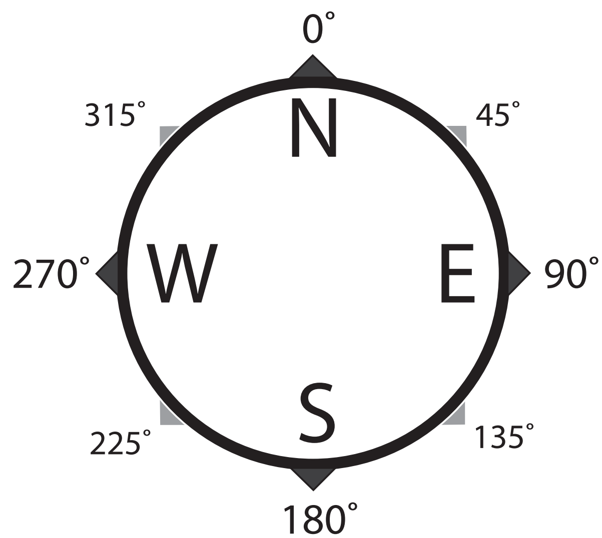

Figure 4. *Compass points with degree increments.*

Emergency Tillage on Growing Crops

Sometimes emergency tillage to prevent the loss of valuable topsoil is necessary on fields that are growing

Table 1. *Prevailing wind erosion direction by month for some Kansas locations (directions measured clockwise with 0=North).*

Location	Prevailing Wind Direction											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chanute	180	0	180	180	180	180	180	180	180	180	180	180
Concordia	0	0	338	158	180	180	180	180	180	180	338	338
Dodge City	0	0	0	180	180	180	180	180	180	180	0	0
Fort Riley	180	180	180	180	180	180	180	180	202	180	180	202
Garden City	0	0	0	0	180	180	180	180	180	180	0	0
Goodland	338	338	338	338	158	180	158	158	180	338	337	337
Hill City	338	338	338	338	180	180	180	180	180	158	337	338
Hutchinson	0	0	0	180	180	180	180	180	180	180	0	0
Olathe	180	338	180	202	180	180	202	202	202	180	180	180
Russell	0	0	0	0	202	202	202	202	202	180	0	0
Salina	0	0	0	180	180	180	180	180	180	180	180	0
Topeka	0	0	180	180	180	180	180	180	180	180	338	180
Wichita	0	0	0	180	180	180	180	180	180	180	0	0

insured crops because of poor residue cover or poor stands of crops (often winter wheat after a dry year). Producers should check with their crop insurance providers regarding insurance rules when considering emergency tillage on a growing wheat crop.

Studies in southwest Kansas and Manhattan demonstrate that by using a 40-inch chisel spacing, operated at 4 to 6 inches deep, wheat yields were reduced by 5.5 bushels per acre where the shanks ran over the wheat plants. Overall, however, the wheat yield was reduced by 1 bushel per acre on the entire field. Emergency tillage on a growing winter wheat crop does not significantly reduce wheat yields of an established crop; therefore, if wheat fields start blowing, emergency tillage is a short-term, viable option.

Emergency Tillage: Speed and Direction

All tillage operations should be perpendicular or across the direction of the prevailing or eroding wind (Table 1). For most of Kansas, this means that emergency tillage should be performed in an east-west direction. Since winds can deviate from the prevailing directions, forecast wind directions and speeds should be taken into consideration in determining actual tillage directions. The best wind erosion control is created with maximum surface roughness when resistant clods cover a major portion of the surface. Research shows that lower travel speeds of 2 to 3 miles per hour generally produce the largest and most resistant clods. Speeds of 5 to 7 miles per hour, however, produce the greatest roughness. Because clod resistance is usually reduced at higher speeds, the effect may not be as long-lasting as at lower speeds. Thus, higher speeds are recommended where erosion is already in progress, while lower speeds might be a better choice in anticipation of erosion.

References

Li, J., Okin, G. S., Hartman, L. J. & Epstein, H. E. Quantitative assessment of wind erosion and soil nutrient loss in desert grasslands of southern New Mexico, USA. *Biogeochemistry* **85**, 317-332, doi:10.1007/s10533-007-9142-y (2007).

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