TECHNICAL NOTE

U.S. Department of Agriculture **Natural Resources Conservation Service**

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METHODS TO DECREASE WIND EROSION ON CROPLAND DURING WATER SHORTAGES IN CALIFORNIA

The following information provides guidance for mitigation practices and alternatives for wind erosion and blowing soil during drought conditions in California.

California is currently undergoing extreme drought conditions, severely impacting many parts of the state. Loss of irrigation water could result in vast acreages of farmland taken out of production, resulting in many acres of bare soil. Abandoned, bare fields are subject to severe wind erosion.

Fields continually subjected to erosion may result in land that is incapable of returning to cropping or vegetative systems. The larger the unprotected field, the more damage to soil, plants and air quality. Soils most vulnerable are coarser textured soils like sandy loams, loamy sands and sands. Not only will vast amounts of precious top soil be lost, but air quality will be impacted as well. Blowing soil can impair vision on major highways and has, in the past, resulted in serious multi-car accidents on major California highways.

The usual practices for preventing soil erosion, such as cover crops, critical area planting, cross-wind trap strips and wind breaks, are not feasible in this situation. Required irrigation water for establishment and long-term survival of the usual methods of vegetative cover may not be available.

Soil is vulnerable to wind erosion when:

1. Soil is dry, loose and finely granulated;
2. Soil surface is smooth with little or no vegetation present;
3. Fields are sufficiently large, therefore susceptible to erosion;
4. There is sufficient wind velocity to move soil.

Winds considered to be erosive are those with velocities that reach 13 miles per hour at a height of one foot above the soil surface. This translates into a velocity of about 18 miles per hour at a 30 foot height and is referred to as the threshold wind velocity.

Wind transport of soil takes place through saltation, surface creep, and suspension. Saltation is individual aggregates lifting off the surface and rebounding to impact the soil surface at 6-14 degrees from the horizontal. Surface creep is sand sized particles set in motion by the impact of saltating particles. Suspension is when finer soil particles, less than 0.1 mm in diameter, are

Prepared by Rita Bickel, State Conservation Agronomist, Resource Technology Staff, Natural Resources Conservation Service, Davis, CA.

dislodged from an eroding area and moved upward by diffusion, remaining in the air mass for an extended period.

This technical note illustrates methods to control wind erosion and soil loss under two different conditions: situations without available water and situations in which there is some available water.

I) WHEN IRRIGATION WATER IS NOT AVAILABLE

A) NRCS can provide assistance on site specific alternatives that protect soil resources and air quality on land taken out of production due to absence of irrigation water.

Methods of controlling wind erosion:

- If a field is taken out of production, and there is residual cover and/or furrows and/or surface roughness post harvest, it is imperative that the cover in the field is not disturbed or tilled-under prior to windy periods.
- Establish and maintain vegetation or vegetative residues to protect soil
    - Planting a temporary cover of small grain, such as barley, planted in 12 to 14 inch rows during the winter season (when some moisture is available), then subsequently leaving standing stubble for cover, provides erosion control. Standing and/or flat residue is effective, with standing stubble the most beneficial for wind erosion control. Effective residue could be 1,000 lb/acre standing residue or 1,500 lb/acre flat residue. Residue amounts needed for protection depend on soil, type of residue, and unsheltered distance, and should be determined on a site-specific basis. Refer to the National Agronomy Manual and wind erosion prediction guides for California.
- When vegetation or residue in the field is unavoidably lost, surface roughening tillage as an emergency measure may be employed.
    - Emergency tillage uses tillage implements to produce soil surface roughness in the form of clods, ridges, and depressions with tillage implements to reduce wind velocity and trap drifting soil. This is difficult to accomplish on coarse textured soils, because coarse soils will not hold clod structures. Emergency tillage with a lister, forming ridged condition with clods on top of furrows, perpendicular to wind direction, will assist in wind erosion control, but success is directly related to soil type.
    - Ridges are less efficient during wind periods than vegetative cover and the soil must have the ability to form clods large enough to withstand wind force that will break them down.
- Establish barriers or trap strips at intervals perpendicular to wind direction.
    - Erection of barriers such as silt fences in key areas (around highways and field perimeters) are temporary actions.
- Application of mulch at least 4 inches deep provides surface cover to prevent erosion. Green waste from urban areas makes excellent mulch for erosion control. Mulching can be applied in strips of specific widths determined by soil texture.

- Land may be temporarily retired and returned to native perennial vegetation. This alternative could prove to be expensive and initially require intense management.

NRCS practices may include, but are not limited to:

Conservation Cover (327)
Cover Crop (340)
Critical Area Treatment (342)
- Straw Mulch
- Hydromulch
- Tackified Straw
- Erosion Blanket

Cross Wind Ridges (589A)
Mulching (484)
Residue Management, Seasonal (344)
Surfacing Roughening (609)

I I) WHEN LIMITED IRRIGATION WATER IS AVAILABLE

A) NRCS can provide assistance on site specific alternatives and recommendations for making crop management decisions.

Alternatives for crop management methods when some irrigation water is available may include:

- Switching to crops that require less water
- Reduction of planted acreage in response to amount of water that will be available, which will be determined by: specific crop's water requirement; efficiency of the irrigation system correlated with amount of water available from water district or wells; and soil type (water holding capacity).
- Portions of fields may be left uncropped, but could be planted to barley during winter season, with subsequent standing stubble left to prevent future wind erosion.
- Mulching at least 4 inches deep reduces water loss and provides surface cover to prevent wind erosion.
- Mulching can be used on orchard floors instead of high water-use cover crops, and may be used between rows/ridges in annual crops.

NRCS practices may include, but are not limited to:

Conservation Crop Rotation (328)
Cover Crop (340)
Irrigation Water Management (449)
Mulching (484)

B) NRCS can provide assistance on site specific alternatives and recommendations for management decisions that result in improved efficiency in water delivery.

Short term actions for stretching a limited supply of water may include:

- Irrigation Water Management (water budgeting and use of water efficiency tools: tensiometers, CIMIS data); monitoring of soil water depletion and crop water use; water wetting front probing during irrigation; water scheduling;
- Improving operation of existing irrigation systems. Look for opportunities to improve uniformity by steps such as: portable sprinkler overlap, providing quicker water advances in surface irrigation, alternate furrow irrigation. Reduce un-captured tailwater by furrow diking and/or adjusting irrigation cutoff times.
- Knowing soil type, texture and capability is key in managing for drought conditions. Soil texture is directly related to water holding capacity, water intake rate, infiltration rate, etc. NRCS soil survey and technical assistance is readily available.
- Knowing crop water needs by crop and stage of growth is another key part of the puzzle; various crops are sensitive to water shortages at specific stages of growth.
- Consider deficit irrigation accepting reduced yields.
- Knowing amounts and keeping records of water and timing from irrigation districts, or wells, is crucial to implementing the alternatives above.

NRCS practices may include, but are not limited to:

Irrigation Water Management (449)

REFERENCES

California Field Office Technical Guide, USDA, Natural Resources Conservation Service, 2009.

California Wind Erosion Prediction Guide, USDA, Natural Resources Conservation Service, March, 1998.

National Agronomy Manual, USDA, Natural Resources Conservation Service, October, 2002.

Soil Erosion by Wind and Measures for its Control on Agricultural Lands, Agricultural Engineering Branch Land and Water Development Division, Food and Agriculture Organization of the United Nations, Rome, 1960.