Drought Management
FACTSHEET

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TILLAGE, RESIDUE MANAGEMENT AND THEIR EFFECT ON SOIL MOISTURE

Tillage practices and crop residue management in annual cropping systems, such as grain production, play an important role in how soil receives and retains moisture. On perennial crops, such as alfalfa, residue management is not normally a concern as fields are tilled and re-seeded at intervals that are usually 5 years or greater, but annual crops require annual tillage.

Tillage practices and crop residue management affect the way water moves into and off of the soil (infiltration and runoff), as well as the way water moves from the soil into the atmosphere (evaporation). During drought periods, efficient use of limited water is important.

Residue Management, Infiltration Rate and Runoff

Under sprinkler irrigation, management of residues from the previous crop can have significant effect on water movement (runoff leading to erosion) and the evaporation from the soil surface. Runoff potential exists when the rate of irrigation exceeds the infiltration rate of the soil.

Low pressure irrigation systems, as may be used on some center pivots, may exceed the infiltration rate of the soil. The presence of crop residues can increase the infiltration rate and decrease the potential for runoff by creating an uneven surface that slows the movement of water.

Runoff can also increase if the soil infiltration rate is reduced over time. A number of factors such as soil texture and structure, excessive surface tillage, and water application can cause a reduction in infiltration. As the size and number of water droplets increases, fine soil particles are consolidated on the surface to form a thin crust which reduces infiltration. Soil crusts can reduce infiltration rates up to 75%.

One way to combat the negative effects of water droplets is to ensure that crop residues are evenly distributed over the soil surface. Crop residues spread in this manner protect the soil by absorbing energy carried by the falling water droplets. This limits soil crust development, resulting in a more consistent infiltration rate throughout the growing season.

Residue Management and Evaporation from Soils

Crop residue on the soil surface reduces evaporation. Most evaporation occurs when the soil is wet. Residue insulates the wet soil from solar energy and reduces evaporation.

When the soil is wet more often, as occurs with irrigation, evaporation increases, and the effect of crop residue is even more important in reducing water losses to evaporation. This also demonstrates why irrigating less often, with more volume per application, is more efficient than frequent, light irrigations, which more frequently wet the soil surface. Crop canopies also play a role in reducing evaporation by shading the soil surface.

A study in Nebraska showed that crop residue (6 tons of wheat straw per acre) in an irrigated corn crop reduced evaporation by 2 to 2.5 inches during the growing season. Even lower levels of residue can have a significant impact on reducing evaporation.

Soil Water Conservation

Use conservation practices that increase water infiltration and minimize water loss:

- protect the soil surface with plants, cover crops, mulches, and residues
- use buffers to capture snow melt, reduce runoff, and prevent erosion
- use manure, cover crops, and crop residues to increase soil organic matter and build soil quality

To achieve these benefits use cropping practices such as:

- rotations with perennial crops such as grasses and alfalfa
- minimum tillage or no-till to reduce evaporation losses

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