Soil Crusting

Soil crusting is an important negative consequence of improper soil management that can rob crops of stored soil water by encouraging runoff. Soil crusts develop when soils are overworked with tillage and then dry rapidly after an intense rain or irrigation. Crusts can prevent emergence, reduce oxygen flow to roots, and set up a barrier to efficient water infiltration. Soil crusting is most common in soils with high silt content and low organic matter, with low soil aggregate stability. High sodium content can make crusting worse. Other than reducing tillage, the best way to minimize crusting and to improve corn water relations is to retain crop residue on the soil surface. Such residue can reduce the energy of falling rain and also reduce drying rates.

Reducing Soil Erosion and Incr
Stored Soil Water

Getting water into the soil instead of letting it run off the field increases water stored in the soil and reduces erosion. There are several common-sense management practices that can accomplish both objectives.

Select the right fields for corn and soybean when using tillage. Corn and especially soybean do not provide excellent erosion control and are therefore best suited to less sloping fields. When sloping fields must be used, special attention should be paid to residue management, contouring, or other practices.

Manage the soil surface to increase infiltration. Reducing tillage allows for residue to form natural dams

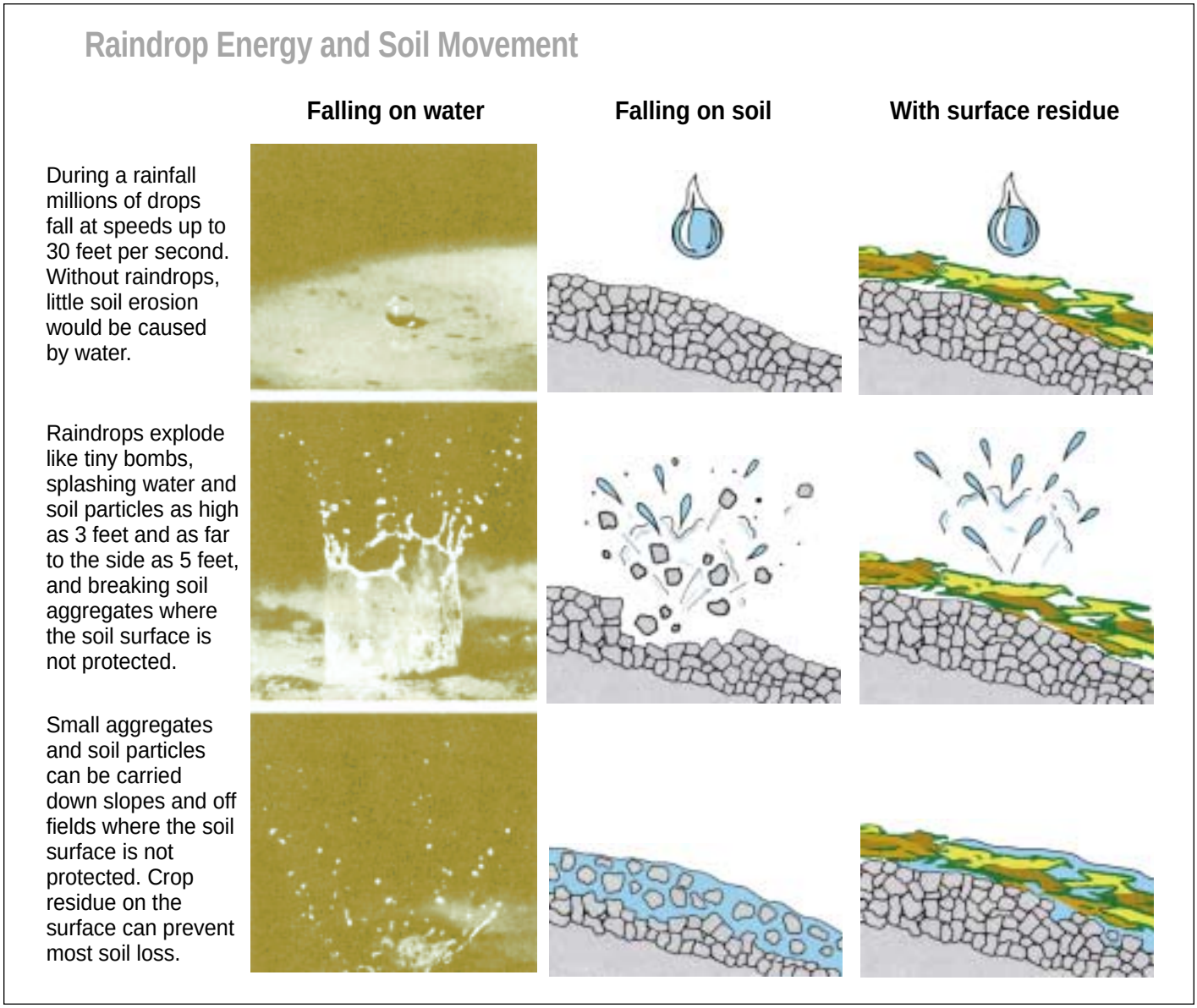

Figure 10.5. Photographs of raindrops falling on water (left), how raindrops falling on unprotected soils can result in soil displacement, (middle), and how surface residue reduces displacement (right).

and protects soil structure thereby allowing better water infiltration. Performing tillage in a way that maintains surface roughness will also increase infiltration. The soil is most vulnerable when it is without a crop. Residue on the soil surface or surface roughness holds water in place longer, and thus allows it to infiltrate.

Use no-till or cover crops on sloping land. Both of these systems help reduce the energy of falling rain, thus dissipating energy that would otherwise loosen soil particles (figure 10.5). Cover crops fit the cropping pattern in some areas, and in the case of legumes can provide a source of nitrogen after they are killed.

Consider engineering practices. Sloping fields may benefit from engineering, such as the installation of terraces, waterways or the use of other practices to meet tolerable soil loss goals. Soil and water management techniques that increase water infiltration and reduce erosion are helpful for corn and soybean production and the environment.

4. Root Growth and Soil Water

Full exploitation of stored soil water requires deep root growth. As soil dries, the movement of water through the soil becomes slower and slower. Although water always moves from wetter to drier zones, the water supply to roots from a deep water table may not provide water quickly enough to keep crops growing at a maximum rate. Roots cannot grow in soils with low water content; they grow in moist soil, but they cannot grow through dry soil to reach moist soil. Roots grow best in slowly drying soil where they can extend downward, always staying in the more easily penetrated, moist soil where they can easily take up water to sustain growth. If they encounter a layer [illegible] soils are dry, they will cease to grow.

Saturated soils also inhibit root and soybean nodule growth. Roots require both aeration and moist soils to move downward into the soil profile. Roots of corn and soybean will grow to, but rarely into, a water table. Roots close to a water table can, however, get a significant amount of water delivered by upward, unsaturated flow to the roots as they take up water and so dry the soil around themselves.

Planting corn and soybean on time provides the best chance for full root expansion. Early in the spring there is a better chance for slow soil drying and steady downward root growth. A later planted crop might encounter rapid soil drying that extends downward more quickly than the roots can grow. As a result, a shallow root system may be left behind in the upper soil horizon, and may be unable to expand out of the layer of dry, high-strength soil. Subsequent rains may not connect the soil surface with moist subsoil, and as a result root distribution may remain shallow for the duration of the crop season. This is a particularly common limitation of double-cropped soybean.

5. Drainage

Providing drainage to enhance removal of excess water from corn and soybean fields is often an economically viable management practice. The type of drainage system that is best suited for each soil is dependent on the internal permeability of the soil and the expected improvement in productivity. In general, poorly drained soils with good internal permeability are the best candidates for tile drainage (figure 10.6), while improving surface drainage is often best for

Figure 10.6. Most subsurface drainage tile are perforated plastic tubes that are placed quickly and accurately with the help of a laser depth control.