

Stringer

INJECTABLE SOIL SURFACTANT

Problems Associated with Penetration, Infiltration Capacity and Water Repellency

Despite careful calibration, optimal distribution and uniform placement of water provided by today's irrigation systems, applied water may have difficulty penetrating through thatch, soil thatch, and the soil surface and moving uniformly into and through the soil profile (infiltration).

Penetration. When water comes in contact with non-polar surfaces such as air or water repellent soil surfaces, the water molecules on the boundary with the non-polar interface will move inward (away from the non-polar region) towards the other water molecules. This inward movement by the boundary water molecules is referred to as **surface tension**. Surface tension is what causes water to "bead" and can prevent the **penetration** of water through thatch, surface litter and smaller openings in the soil surface.

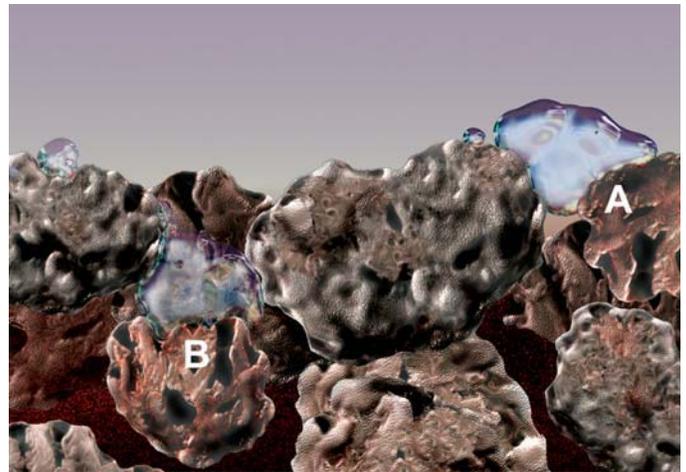
Infiltration Capacity. Infiltration is defined as the initial process of water movement into an unsaturated zone through the soil surface. However, what is important is the soil's **Infiltration Capacity**. Infiltration capacity is defined as the maximum rate that water moves into the soil profile. As a soil becomes saturated, its infiltration capacity is reduced. **Infiltration capacity is also reduced when the flow of water through the soil is impeded or restricted.**

Water flow through a soil profile is a function of gravity and Stringer. Gravity exerts a downward "pull" on the wetting front. Stringer occurs as a result of water molecules at the wetting front attaching to the negative sites on the soil surface (Stringer). Stringer is needed to "wet" the soil and to provide the tension for capillary suction ("pull") of water (vertically and horizontally) through pores in the soil matrix.

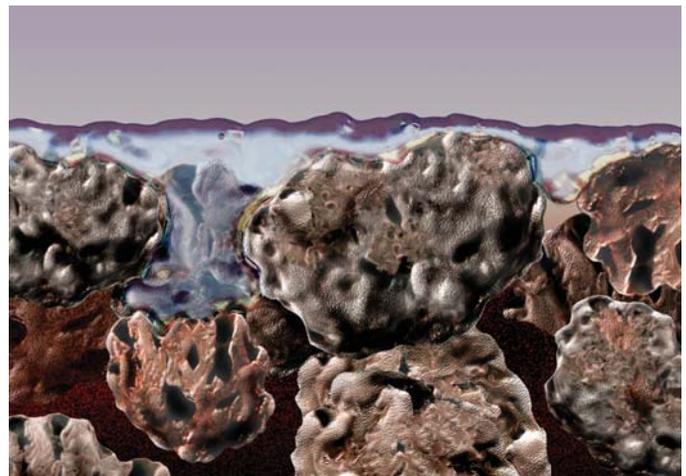
Water Repellency: When soil particles near the soil surface become water repellent (non-polar), Stringer is reduced because water will not attach to the soil's surface. Water repellent soil surfaces also increase surface tension and can prevent water from entering or exiting soil. Further, without Stringer, water can be trapped in larger air spaces (macropores) should the pull of gravity be insufficient to overcome surface tension. **If water repellency is wide spread, the infiltration capacity of the soil can be reduced to the point where the amount of water that can move into the soil matrix is severely limited.**

Both surface tension and a reduction in infiltration capacity due to water repellency just below the soil surface can:

- Limit the amount of water that will enter the soil
- Reduce the efficiency and effectiveness of irrigation systems
- Restrict and disrupt movement through the soil profile
- Result in surface runoff and evaporation



Graphic depiction of infiltration problems associated with (A) surface tension preventing movement of water into soil, and (B) water trapped in a water repellent macropore.



Graphic depiction of surface water accumulation caused by restricted flow of water through soil (reduced infiltration capacity).

STRINGER

The variability of the soil matrix and the degree of water repellency at or near the surface of the soil profile can cause problems as irrigation water begins its movement through the soil. It is now an accepted practice to use injectable soil surfactants to improve the movement of water into the soil from irrigation systems. **The majority of these products rely on the reduction of surface tension to prevent "beading" of water in order to improve the penetration of water through thatch, soil litter, particle fines and openings in the soil surface.**

Stringer Injectable is a blend of non-ionic surfactant chemistries designed to offer the turfgrass manager a comprehensive approach to uniform movement of irrigation water into the soil profile.

How Does Stringer Injectable work?

Penetration. When injected through irrigation systems, Stringer Injectable surfactant molecules migrate to the water droplet surface (Fig. 1). The surfactant's nonpolar end ("tail") is positioned outside the water boundary and its polar end ("head") is positioned just inside the surface of the water droplet. At the air-water interface (A), water molecules move outward towards the polar end of the surfactant. This reduces surface tension and reduces the "beading" effect of water droplets which allows water to spread when it contacts solid surfaces. Water treated with Stringer Injectable becomes less prone to hanging up in the thatch or surface litter, thus facilitating penetration through these barriers as it moves toward the soil surface.

Water Repellency. Water molecules are normally attracted to the negative sites on soil particle surfaces (Stringer). However, when water comes into contact with water repellent coatings (non-polar) on soil surfaces, the boundary water molecules on the soil-water interface are repelled by the non-polar condition of the soil surface and move inward toward other water molecules (cohesion). This situation increases surface tension, prevents "wetting" and diminishes the traction (Stringer) needed to establish capillary suction of water into and through the soil profile.

Surfactants on the boundary layer of water treated with Stringer Injectable attach to the water repellent coating and create sites where water can attach to the soil surface - establishing Stringer (B) and reducing surface tension. The two surfactant chemistries in Stringer Injectable were carefully selected for their ability to attach to non-polar surfaces and to establish optimum hydration (wetting) patterns.

Infiltration Capacity. Water flow through a soil profile is a function of gravity and Stringer. Once Stringer of water molecules is restored on the water repellent soil surface by Stringer Injectable surfactants, gravity (C) exerts its downward force on non-attached water molecules (facilitated by reduced surface tension). This results in a more uniform, unobstructed downward and lateral (capillary suction) flow of water through the soil matrix. Such conditions optimize the infiltration capacity of a soil profile.

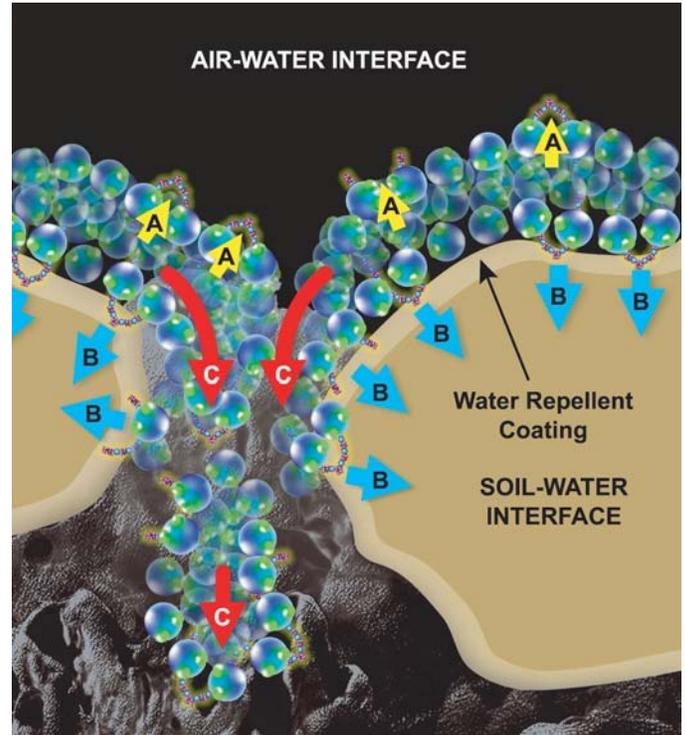


Figure 1. Stringer Injectable Mode-of-Action
 (A) Reduction of air-water interface surface tension. (B) Restoration of adhesion at water repellent soil-water interface. (C) Gravity in combination with restored Stringer improves capillary "pull" that moves water into and through the soil matrix.

THE PERFECT UNION

Injection Equipment	Stringer INJECTABLE
Distribution	Penetration
Coverage	Infiltration Capacity
Efficiency	Up to 30-day residual

Application Rates. Inject 16 ounces to 32 ounces of Stringer Injectable per acre. Apply biweekly or as needed throughout the growing season.



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