

This presentation premiered at WaterSmart Innovations

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**Using Soil Wetting Agents to Improve
Turfgrass Irrigation Efficiency on Water
Repellant Soils**

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Background

- **16,000 golf courses in U.S.**
- **25,000 golf courses in the world**
- **Early 1960s, USGA Green Section wrote specifications for putting green construction.**
- **Primary component, sand (80 percent) (prior to USGA, greens constructed of native soil)**
- **Thereafter, problems began to occur**

Localized Dry Spot

The occurrence of an irregular area of turfgrass that for no apparent reason begins to show signs of drought stress.



MANY POTENTIAL CAUSES OF LDS



**Water droplets sitting on
surface of soil core taken from LDS**



Determining Soil Water Repellency

Water Drop Penetration Test

WDPT (seconds)

Degree of repellency

0 – 5

none

5 – 60

slight

60 – 600

moderate to high

600 – 3,600

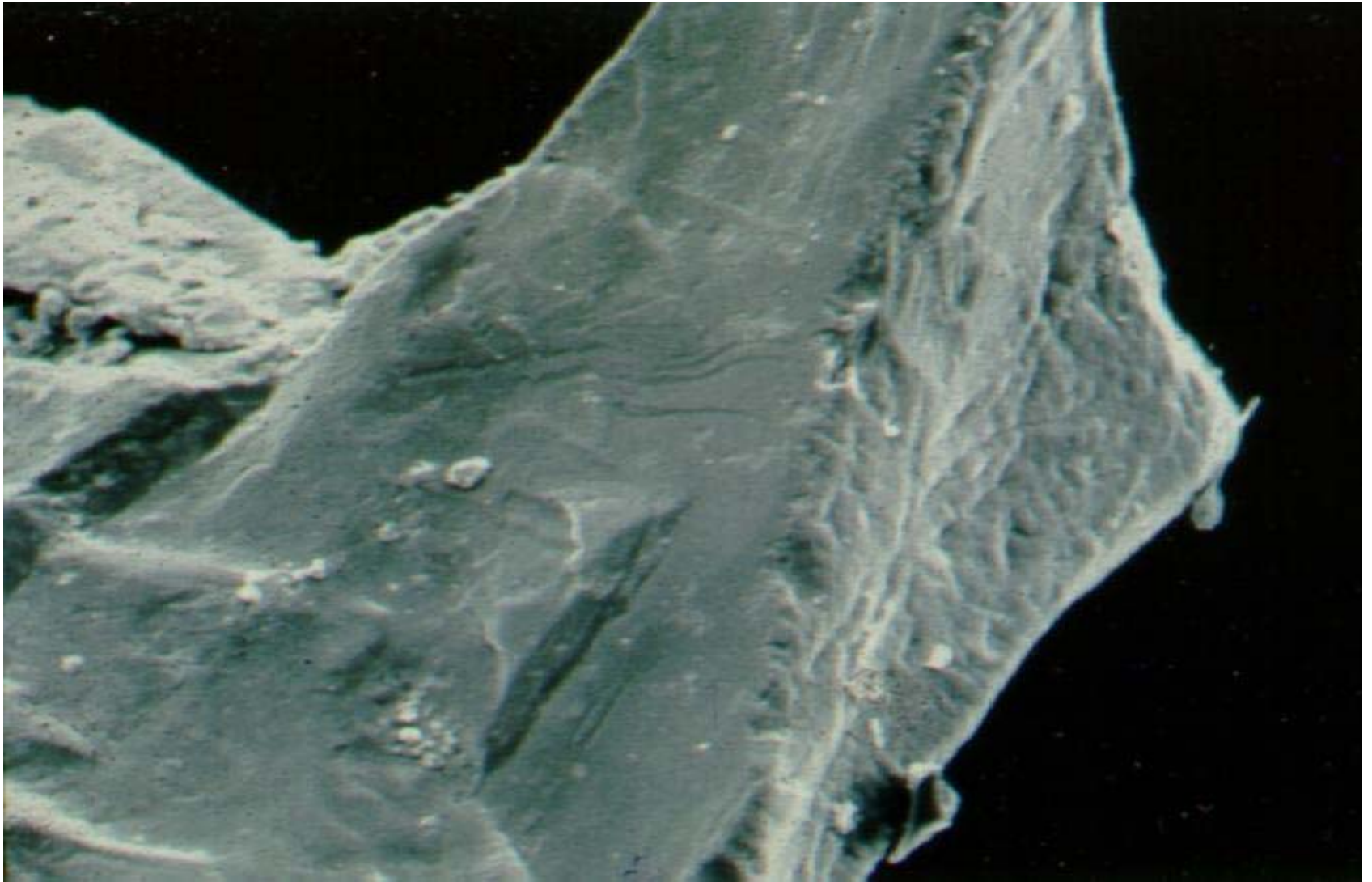
severe

> 3,600

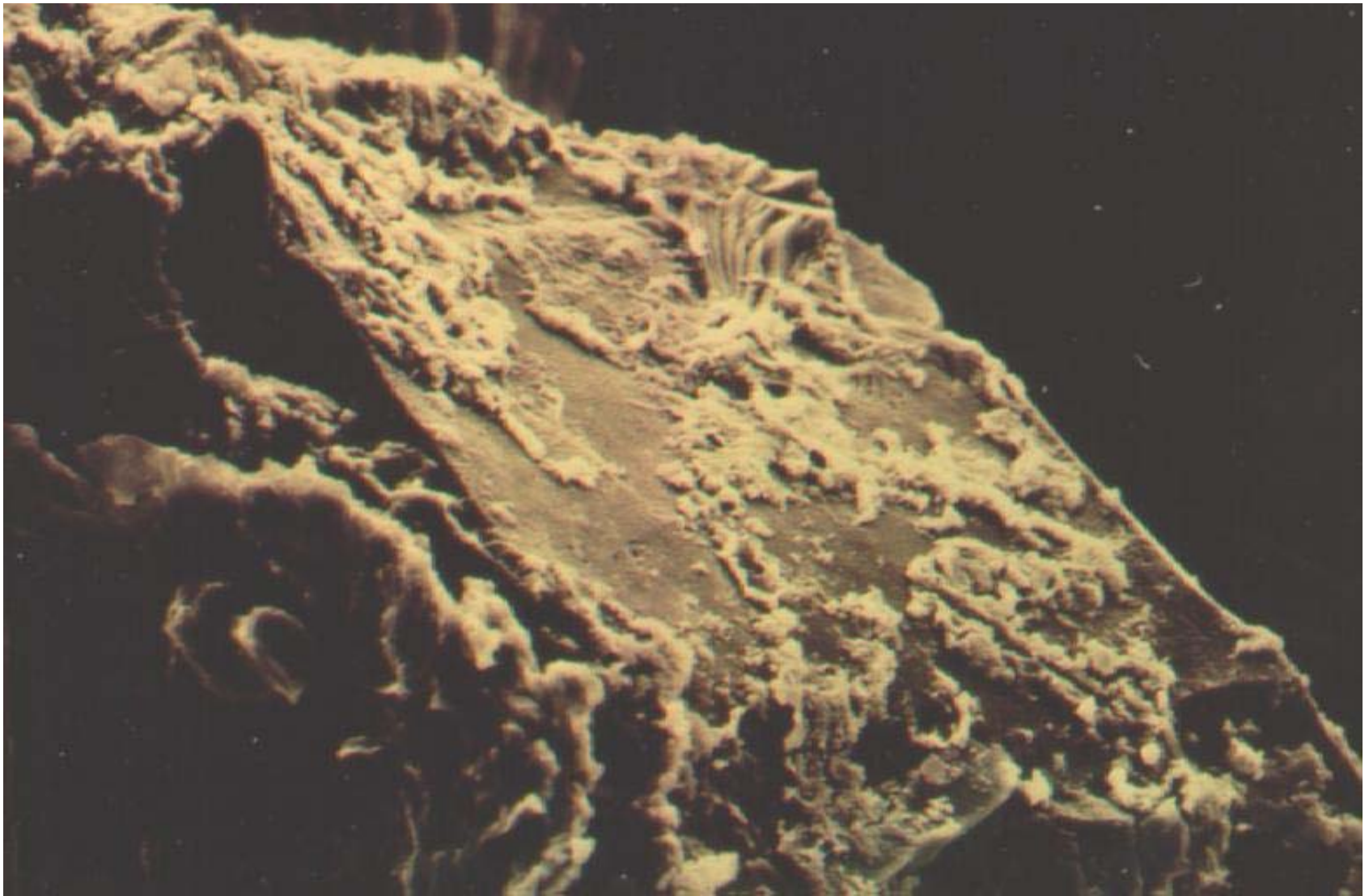
extreme

Electron Microscopy

There was a difference between sand particles from LDS areas compared to healthy areas.



**Electron micrograph of sand
particle with no coating**



**Electron micrograph of sand
particle with coating**

DECOMPOSITION OF ORGANIC
RESIDUES WITH THE RELEASE
OF PLANT NUTRIENT ELEMENTS

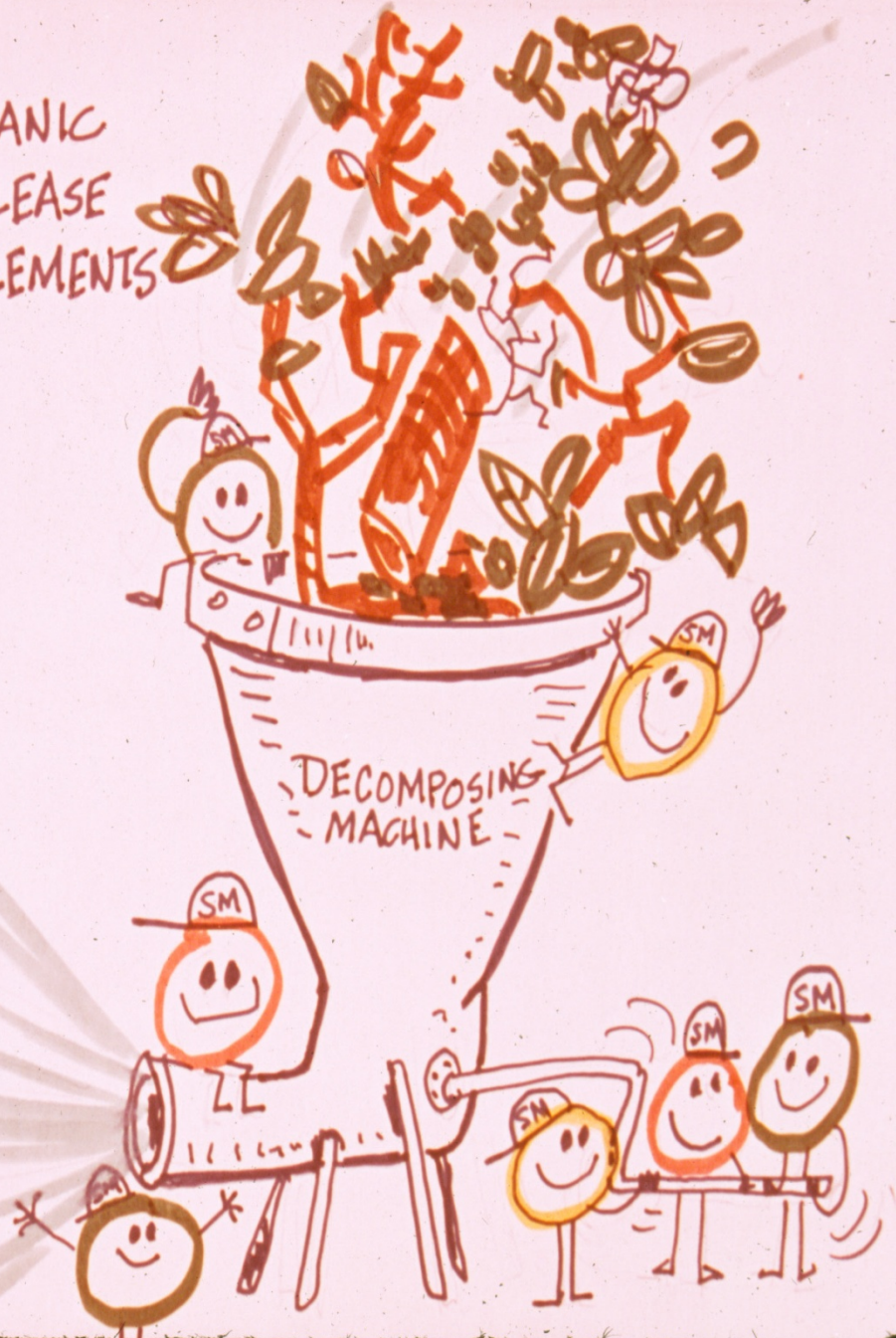
PHOSPHORUS

CARBON

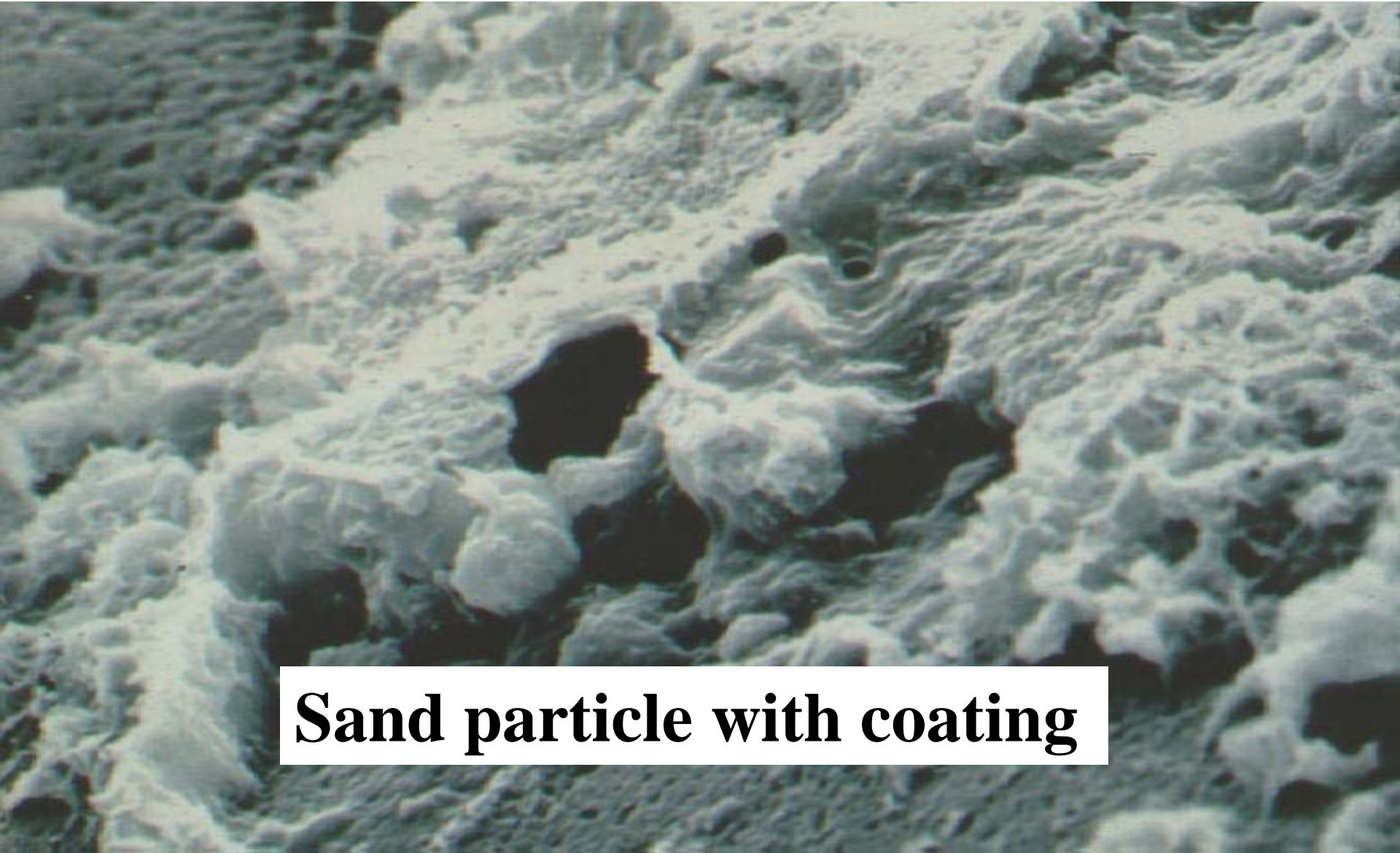
SULPHUR

NITROGEN

POTASSIUM



These organic compounds, when allowed to dry, become very water repellent.



Sand particle with coating



**Tends to be a
surface phenomenon
Top 2 inches**

(Up to 6 inch depth)

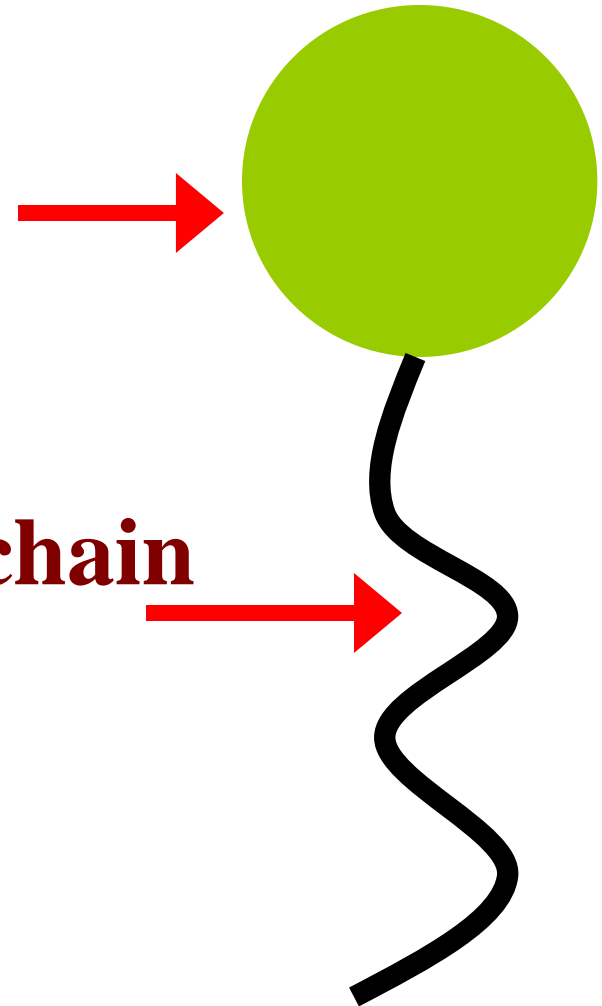
Best management approach is the use of soil surfactants or wetting agents.

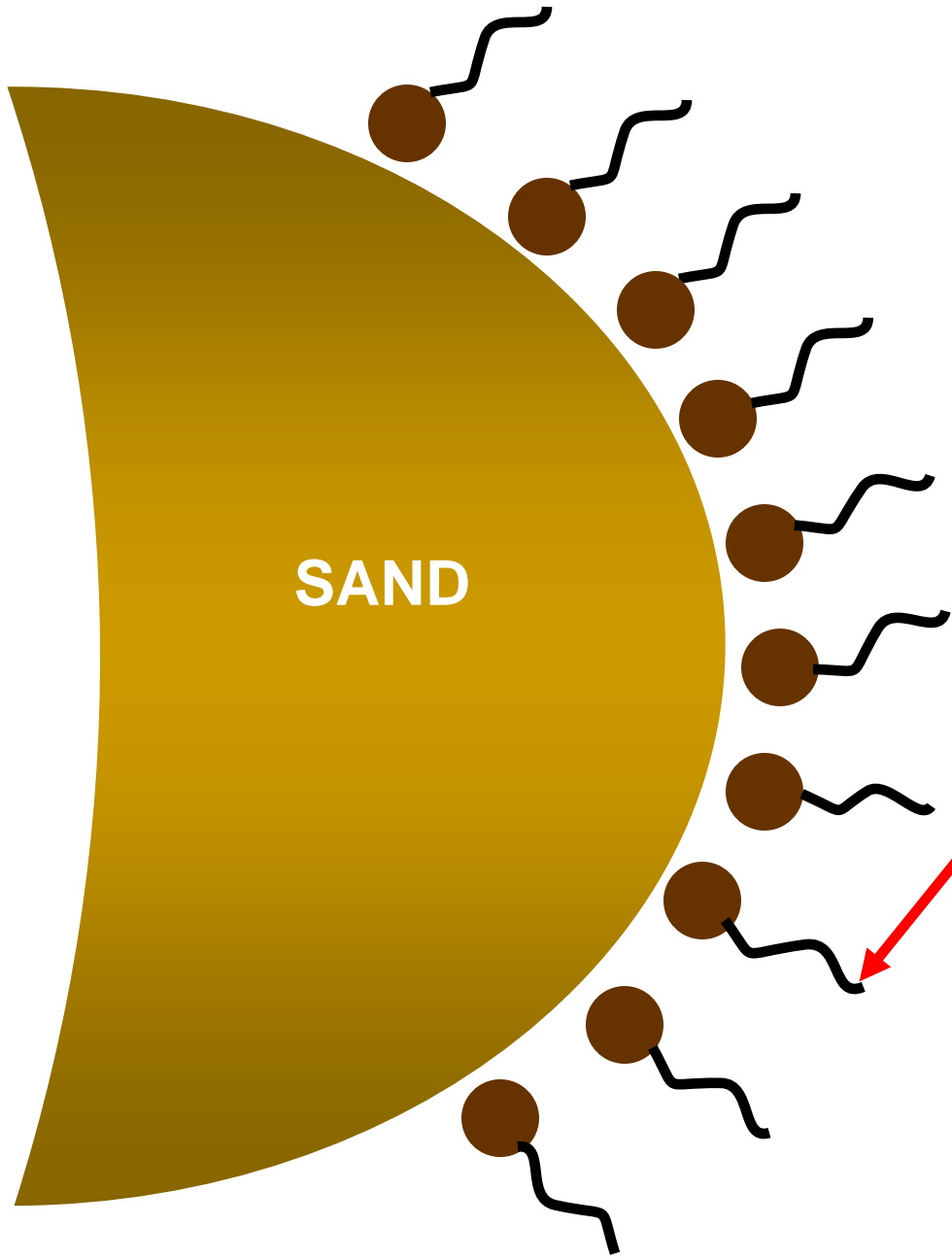
SURFACTANTS

HAVE :

**1. Water soluble group
(hydrophilic/polar)**

**2. Oil soluble hydrocarbon chain
(lipophilic/nonpolar)**

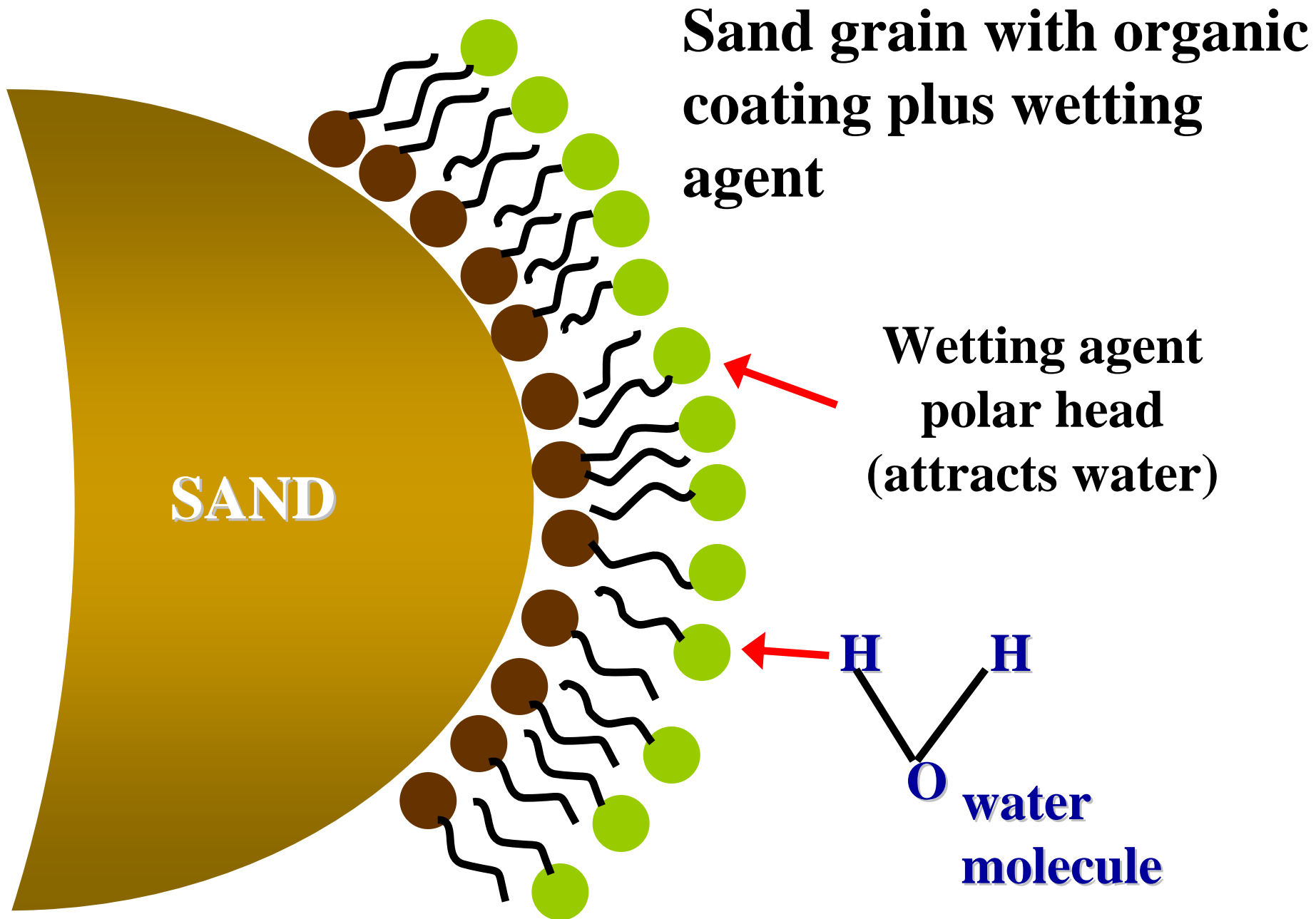




**Sand grain
with organic
coating**

**Non-polar end
(will repel
water)**





Sand grain with organic coating plus wetting agent

Wetting agent polar head (attracts water)

H O H
water molecule

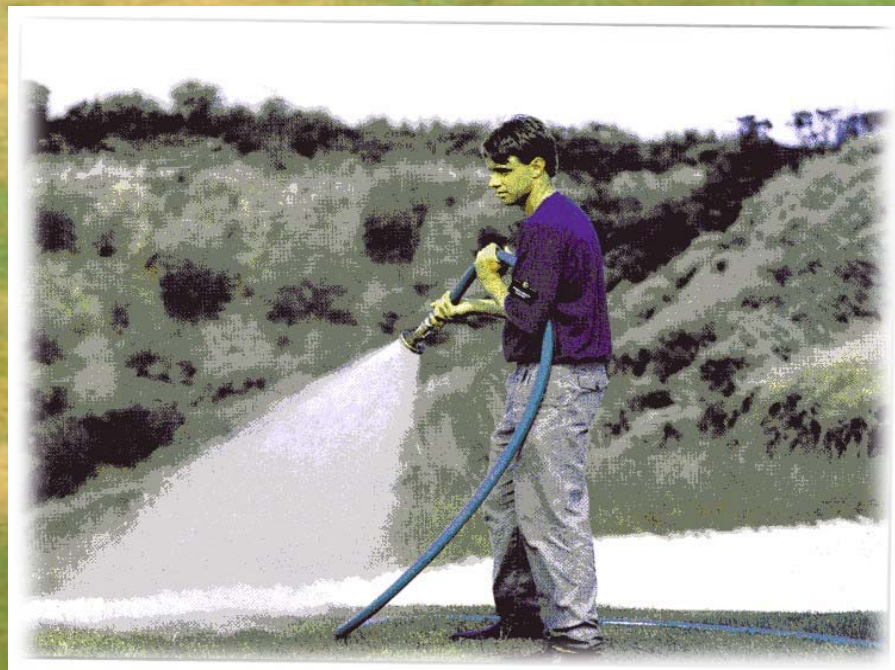
SAND




Survey of golf course superintendents

“Do you or have you used a wetting agent under certain circumstances?”

98%



A photograph of a golf course green. The green is mostly green but has several distinct, irregular patches of brown and tan, indicating areas where the grass is dead or severely stressed. The text is overlaid on the image in a large, bold, black serif font.

**Degree of water
repellency
varies across green
(mild to severe)**



Depth (in.)	VWC	VWC
0.5	8.0	18.0
1.5	1.3	15.8
2.5	2.0	3.9
3.5	1.2	1.0
4.5	1.0	0.9

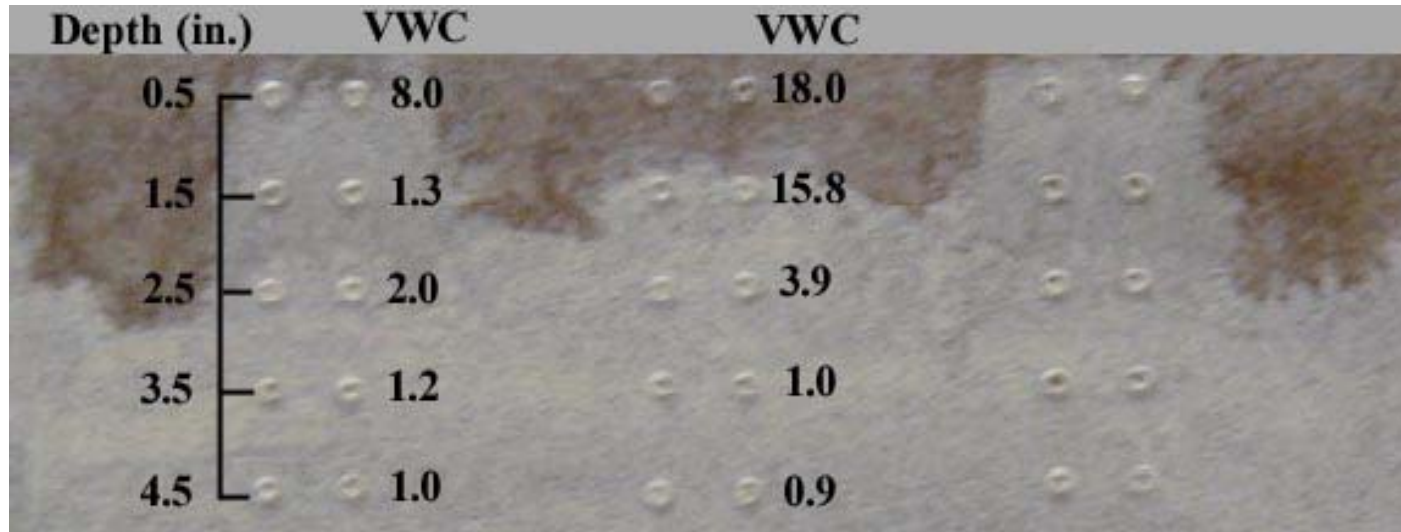
“Can wetting agents improve irrigation efficiency?”

(save water)



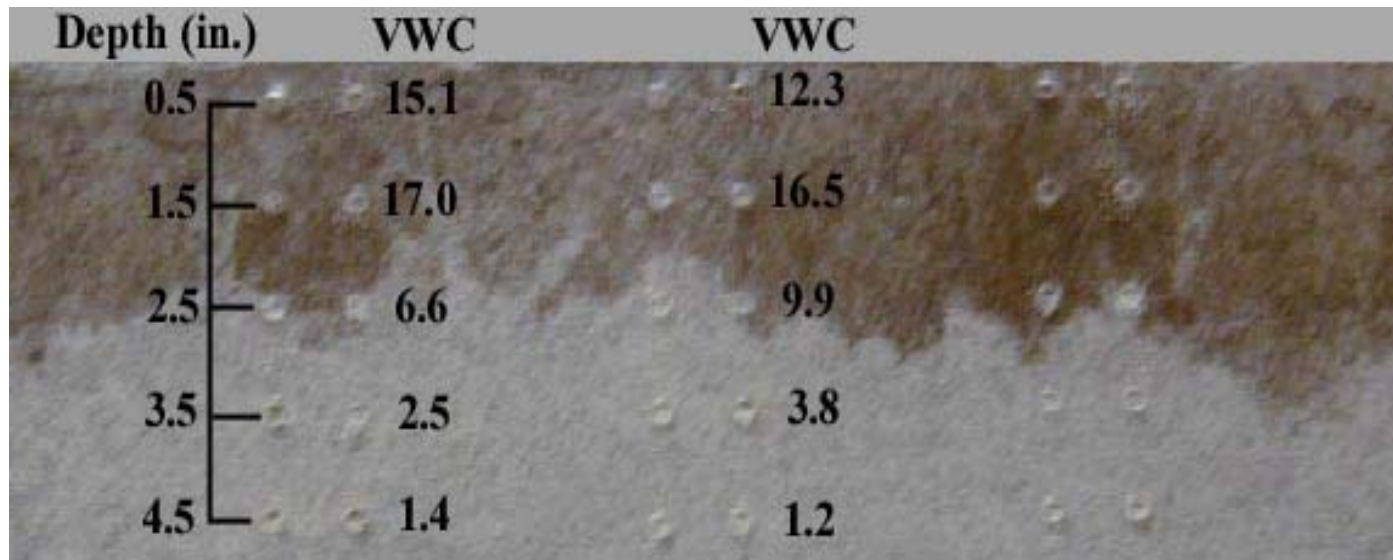
NO WETTING AGENT

Depth (in.)	VWC	VWC
0.5	8.0	18.0
1.5	1.3	15.8
2.5	2.0	3.9
3.5	1.2	1.0
4.5	1.0	0.9

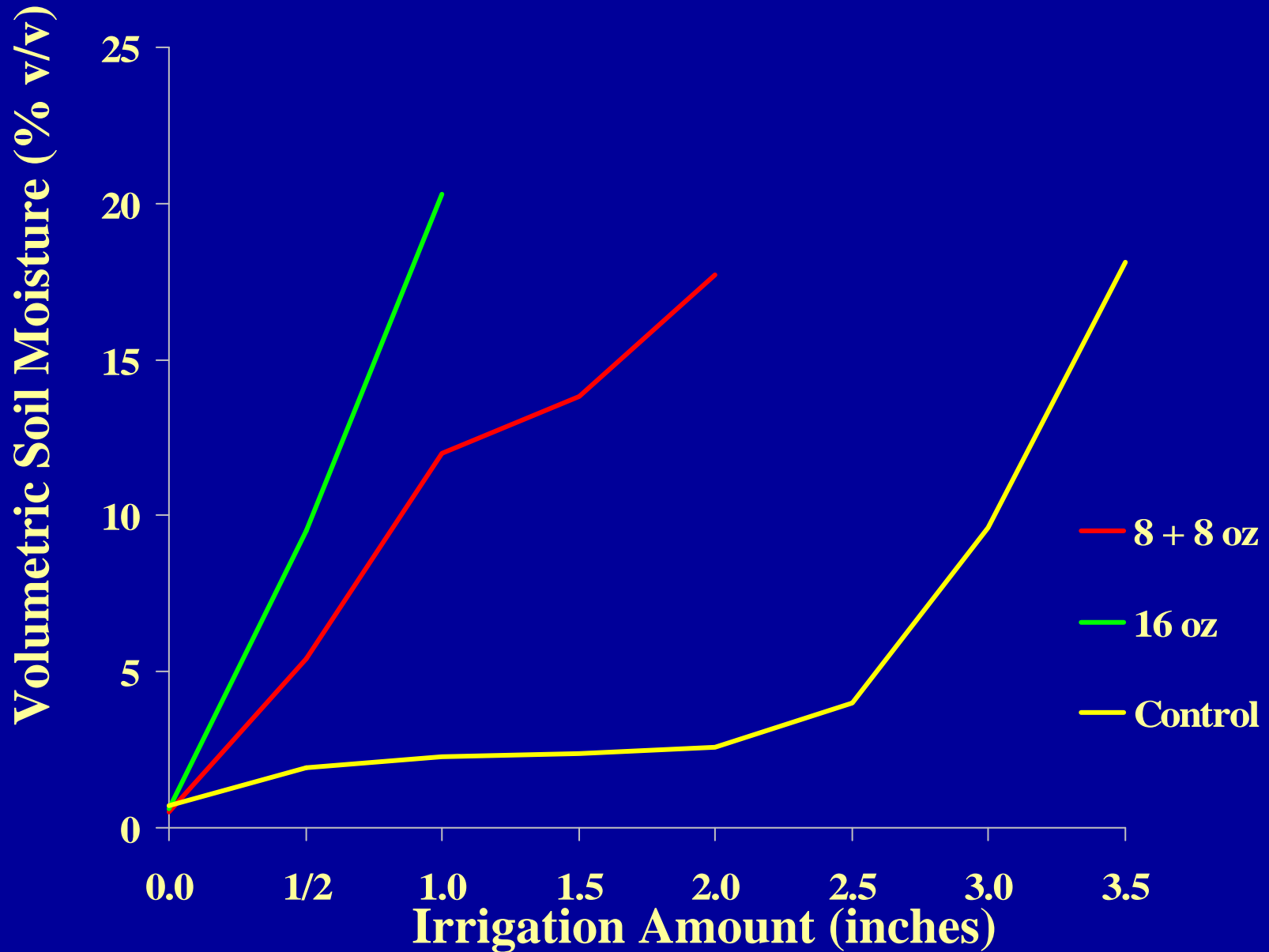
A photograph of a soil core with a vertical scale on the left. The scale is marked at 0.5, 1.5, 2.5, 3.5, and 4.5 inches. Two columns of circular soil samples are visible, each corresponding to a depth. The soil is light-colored with some brownish spots. The data values are printed next to each sample.

WETTING AGENT

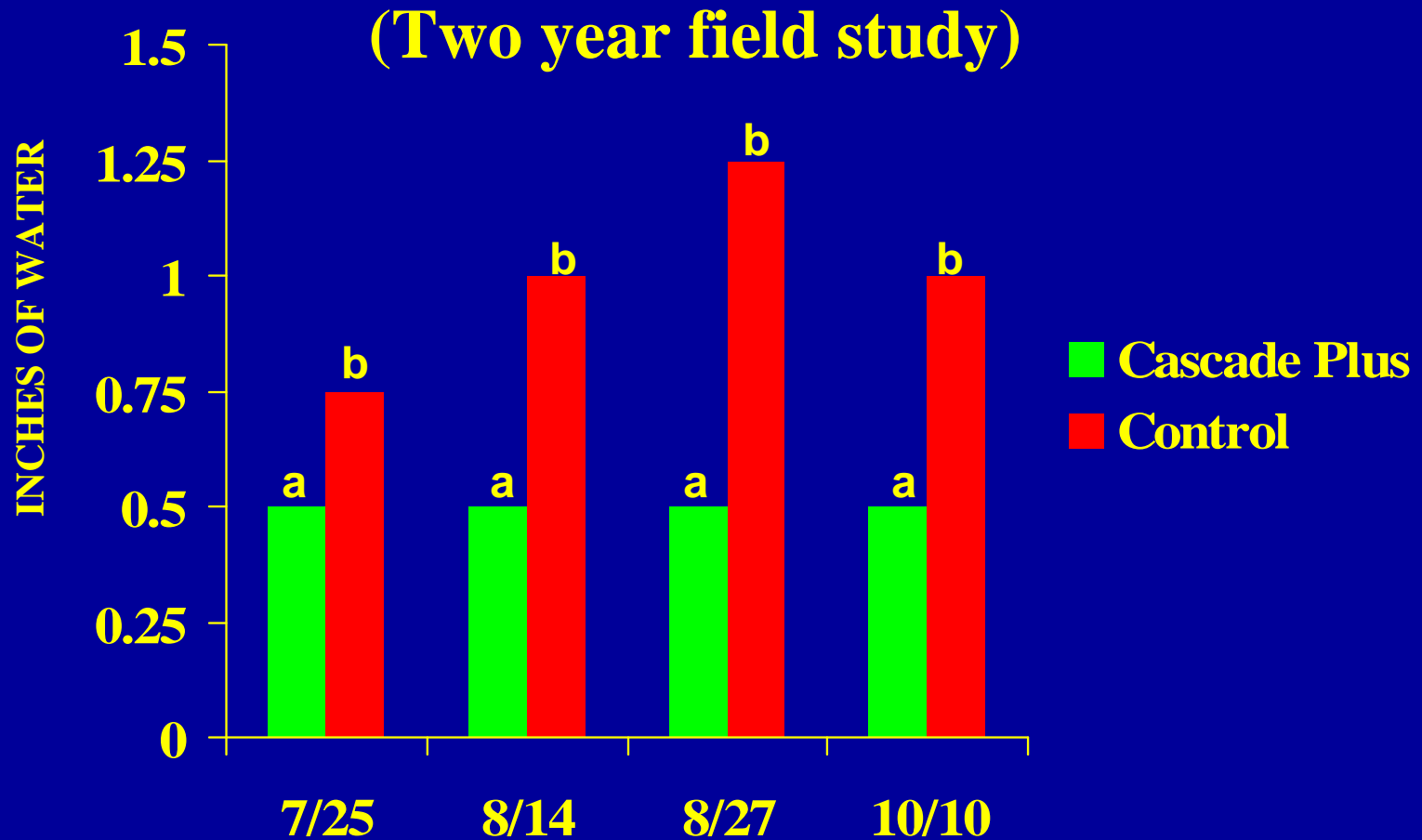
Depth (in.)	VWC	VWC
0.5	15.1	12.3
1.5	17.0	16.5
2.5	6.6	9.9
3.5	2.5	3.8
4.5	1.4	1.2

A photograph of a soil core with a vertical scale on the left. The scale is marked at 0.5, 1.5, 2.5, 3.5, and 4.5 inches. Two columns of circular soil samples are visible, each corresponding to a depth. The soil is light-colored with some brownish spots. The data values are printed next to each sample.

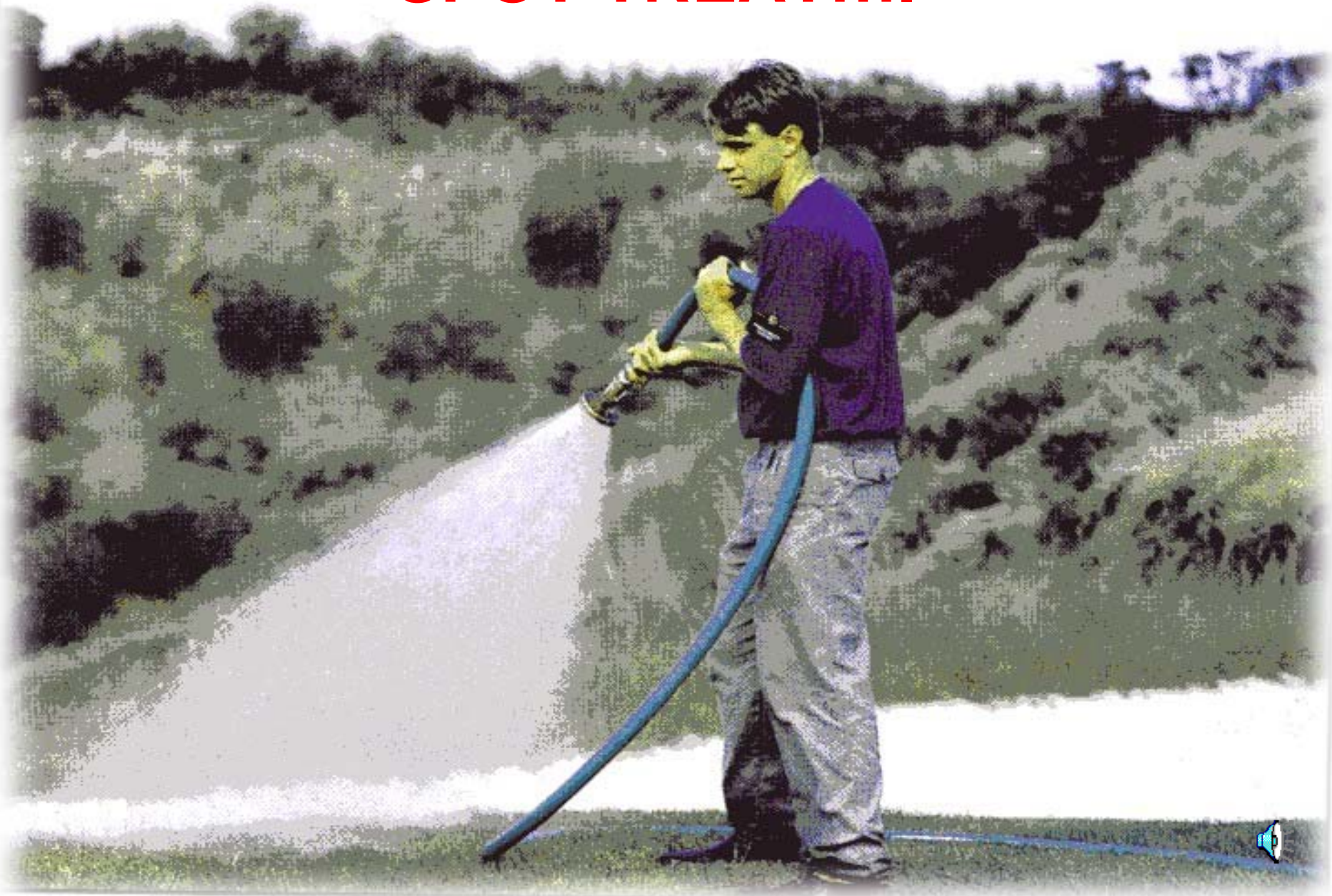
Soil moisture as affected by a wetting agent (Irrigated immediately after initial application)



Amount of irrigation water needed to raise soil moisture from approximately 5% to 15% on a creeping bentgrass green.

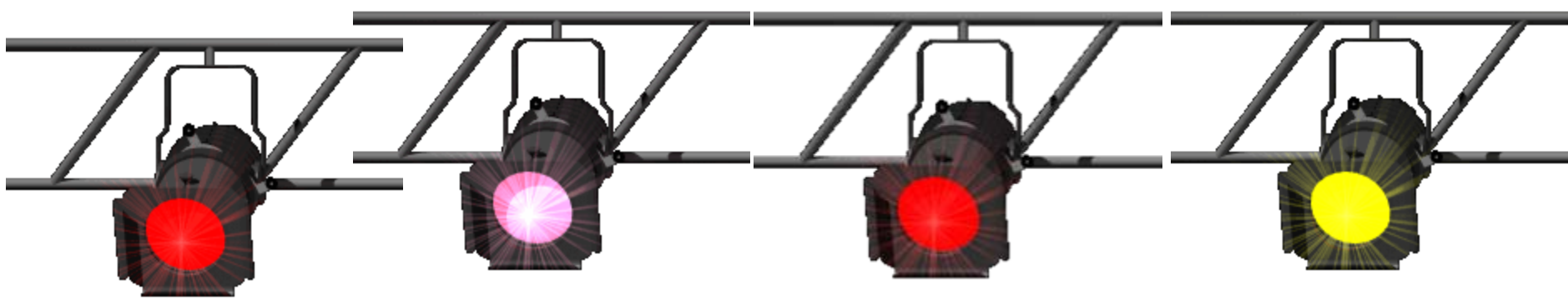


SPOT TREAT....



...TREAT ENTIRE TURF AREA





THANK YOU!

