THE EFFECT OF WETTING AGENTS ON THE WATER USE RATE OF MERION KENTUCKY BLUEGRASS

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Surface-active agents have been applied to water repellent soils to improve their infiltration and percolation rates. In water repellent soils or thatch, surfactants decrease contact angles between water and the repellent soil. Infiltration is improved. Wetting agents applied to normal soils of which low contact angles already exist will decrease the surface tension of water and capillary attraction. It is generally thought that wetting agents should primarily be applied to water repellent soils where the beneficial effect of lowered contact angles overcomes the effects of decreased surface tension. Non-ionic surfactants should be used on turfgrasses. The ethers are most effective on sands or clays while the ethanols are most effective on organic matter.

The objective of this study was to determine the effect of wetting agents on the water use rate of turfgrasses.

MATERIALS AND METHODS

Sod plugs of Merion Kentucky bluegrass were established on a loamy sand-soil mixture in one pint waxed cheese cups. The soil surface of the plug was 1 cm. below the rim of the cup. Adequate drainage was provided by punching five holes in the bottom of the container. The plugs were treated with a complete nutrient solution and were grown for 1 week in the greenhouse under an automatic irrigation system before the experiment was conducted. The cutting height was kept at 6 cm (2 1/2 inches) throughout the study.

The cups were submerged in a solution containing 0, 200, 1,000 and 5,000 ppm of Aquagro or Hydrowet for 20 minutes. Each cup then drained for 45 minutes and was weighed. After 24 hours, the cups were weighed again and the difference was recorded as water loss through drainage (Table 1).

A second cup without holes was added to the bottom of each cup to catch any further drainage and was also weighed. The cups were then placed on a rotating platform in the Aminco-Air wind tunnel. The environmental conditions in the chamber were as follows: The temperature was controlled at 31°C (88°F), the relative humidity was controlled at approximately 35%, and the wind speed was adjusted to 186 cm per sec. (4 mph). A light producing 250 f was placed over the chamber to induce greater stomatal opening. These conditions were chosen to maximize the water use rate.

The cups were removed from the wind tunnel after 4 and 8 hours for weighing. The difference in weight is reported as water loss in Table 1. The data presented (a mean of six replications) was subjected to an analysis of variance yielding a significant F test. Mean separation was carried out by Duncan's multiple range test.

RESULTS AND DISCUSSION

While trends of higher drainage rates with higher levels of both surfactants seemed apparent, these trends could not be proven statistically (Table 1). Much variability was encountered, probably due to unusual patterns of water flow to the five holes in the cups.

However, after only 4 hours, a significant reduction in the water use rate of the turfgrass occurred at 200 ppm compared to 0 ppm (Table 1). Higher levels of surfactants did not produce further changes in water use rates. The data recorded at 8 hours supports that found at 4 hours. When the water use rates of those receiving a wetting agent are averaged and compared to the control, Aquagro reduced

the water use rate by 16% when measured at 4 hours and 14% over 8 hours. Hydrowet reduced the water use rate by 14% over 4 hours and by 12% over 8 hours.

The cohesion-tension theory of water movement in plants may explain the reduction in water-use-rate. According to this theory, in order for the water to move through the sieve tubes via roots (xylem) out of the leaves and into the atmosphere a continuous chain of water molecules must exist. This is vital as the water molecules must be able to adhere to the sides of the tubes in order to be pulled to the tip of the plant by capillary action. But, since the chemical properties of these surfactants reduce the interfacial attraction between water molecules and other surfaces (i.e. sieve tubes) this process is impaired and thus the reduction of water-use-rate.

It would appear from this data that the water use rates of grasses could be reduced as much as 10%. This could be an obvious savings in water. However, whether or not a reduction in the quantity of water that flows through the turfgrass plant improves or impairs growth or stress tolerances is not known.

Table 1. The effect of surfactants on the drainage and water use rate of Merion Kentucky bluegrass.

Wetting Agent	Concentration ul/l	Water Loss g/pot		
			Water Use Rate	
		Drainage	4 hrs.	8 hrs.
Aquagro	0	11.8 a	27.9 cd	48.8 cd
	200	14.8 a	24.3 ab	43.4 ab
	1000	20.9 a	24.0 ab	42.5 ab
	5000	26.4 a	22.2 a	39.9 a
Hydrowet	0	7.9 a	29.3 d	51.6 d
	200	12.4 a	25.1 abc	45.2 bc
	1000	16.9 a	26.0 bc	46.2 bc
	5000	18.1 a	24.9 abc	44.1 abc

Values having the same letter within vertical columns are not significantly different at the 5% level, DMRT.