



HUMECTANT COMPLEX

Cistern is a three way blended soil surfactant , with one of its component a Humectant Compound.

Humectants are designed to “hold / “retain” moisture in the upper portions of the soil profile.

Humectants will lessen the negative effect of evaporation of irrigation events. There is considerable loss of applied water due to surface evaporation due to sunlight and wind conditions.

The other two surfactants molecules are there to ensure infiltration and penetration of water into the soil profile.



- Cistern is a 3-way soil surfactant and humectant complex that aids in making water applications more efficient and effective.
- Cistern is formulated to aid in holding more water in the root zone.
- Cistern is designed to retain water in periods of drought , heat stress conditions and Government Mandates = reduced irrigation requirements

Cistern is designed for holding water where the root zones are located in dry to drought conditions.



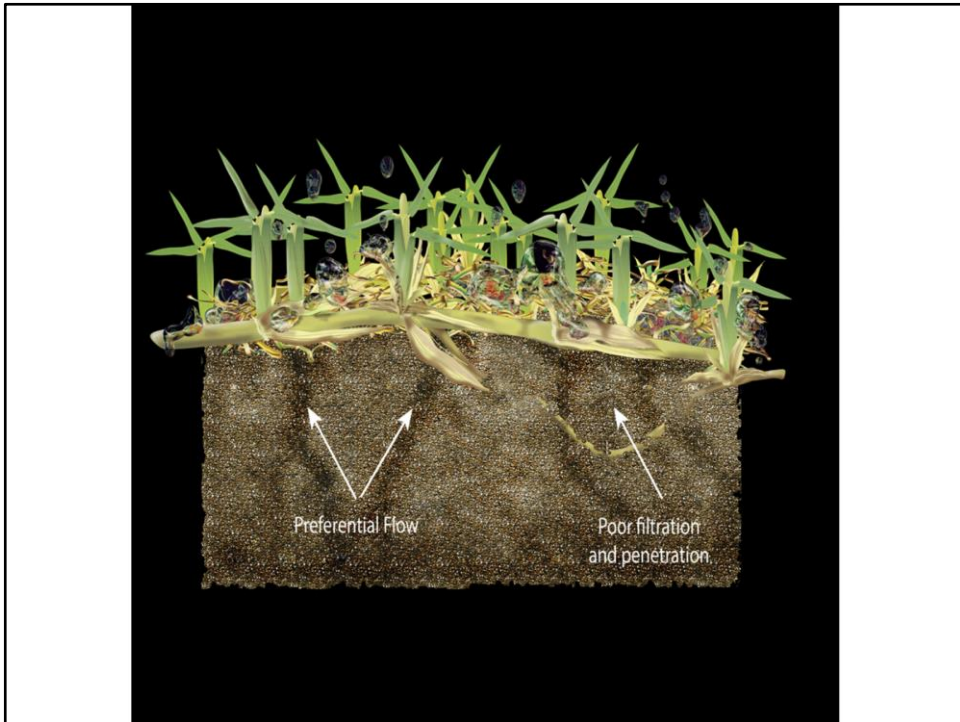
- Cistern L and G = Lawns, Home Owners Associations, Landscape Operations, Commercial Property
- Cistern G is on a 150 SGN carrier
- Cistern is safe to people, pets and environment
- Cistern L and G is safe for turf –NO BURN

Cistern is available in two formulations a liquid and granular
Cistern is safe to use

Cistern L rate is 6 oz. per 1000 sq. ft. applied in a 2 gallon spray solution per 1000 sq. ft. Cistern should be applied every two to four weeks or as needed.

Cistern G rate is 2 pounds per 1,000 sq. ft. : should be applied every 2 to 4 weeks or as needed.

Cistern L and G is safe for pets, people and the environment

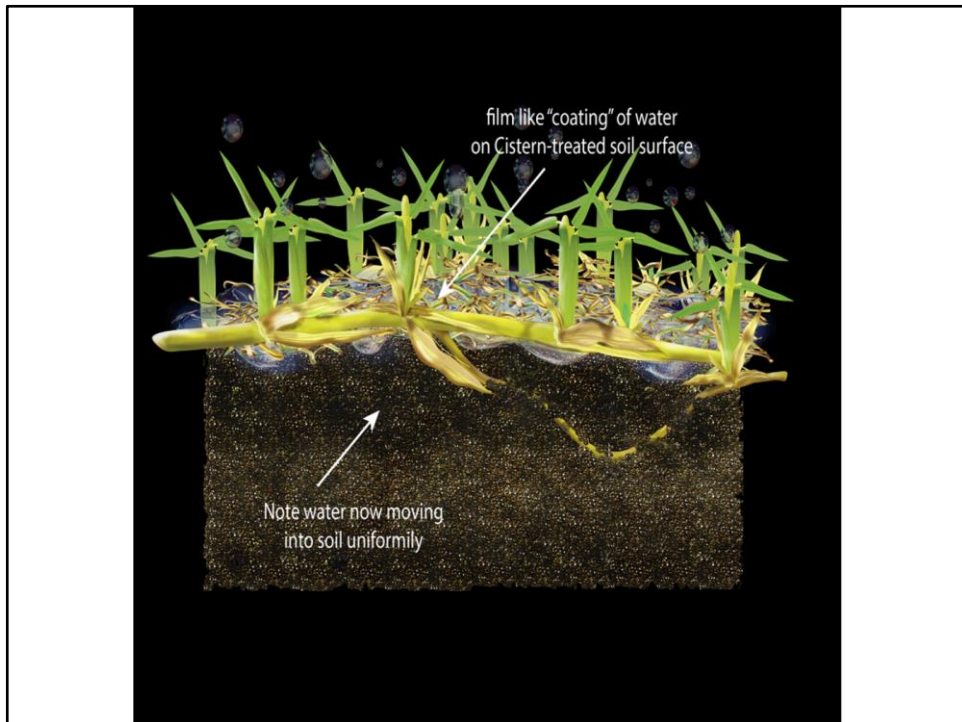


Once irrigation water or rain events happens = water does not flow uniformly thru the soil profiles .

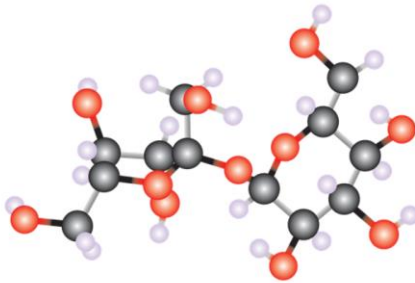
Water will move through the soil in certain preferential flow patterns. These patterns of water movement are not uniform thru out the root zone profile.

As you can see, the root zone will have dry areas even though it is believed that sufficient water / irrigation moves has been applied.

Once gravity has takes over, the finger flow / preferential flow will move the water BELOW the root zones leaving roots unable to utilize the water applied.

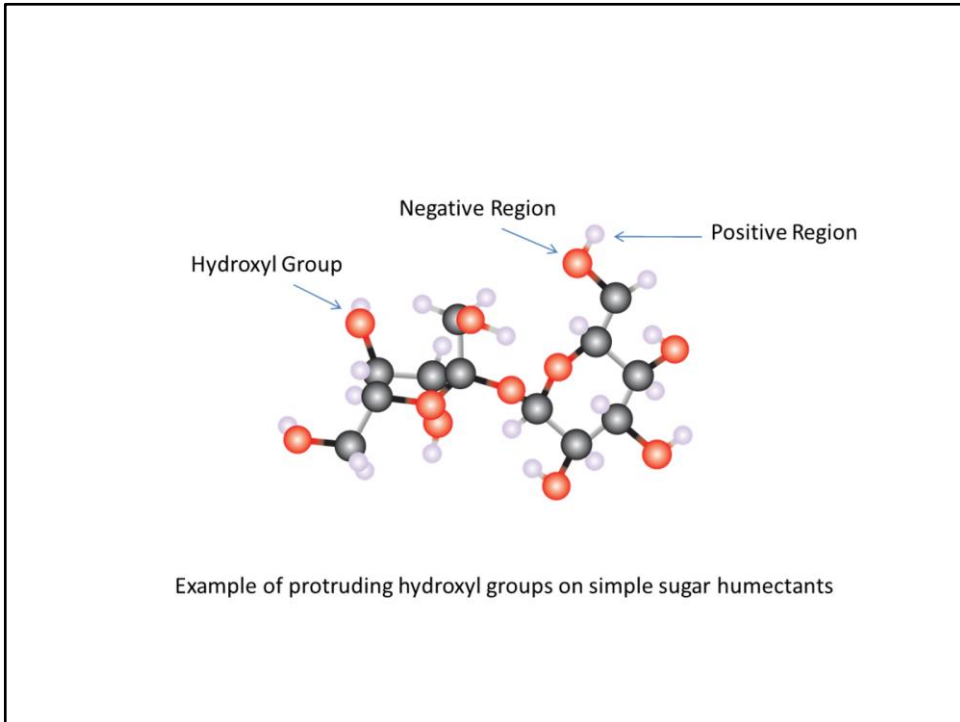


When Cistern is applied to turf, it eliminates the beading / collection of water on surface of lawns by allowing applied water to overcome the water repellency of the thatch and decayed turf grass plant litter. Water can now infiltrate and move UNIFORMLY into the soil profile and provide a uniform hydration through out the root zone.



Humectants are usually found as mixtures of several short-chained sugar molecules and longer chained polysaccharides. Both contain several water loving hydroxyl groups (OH) that protrude laterally along the polyol molecule.

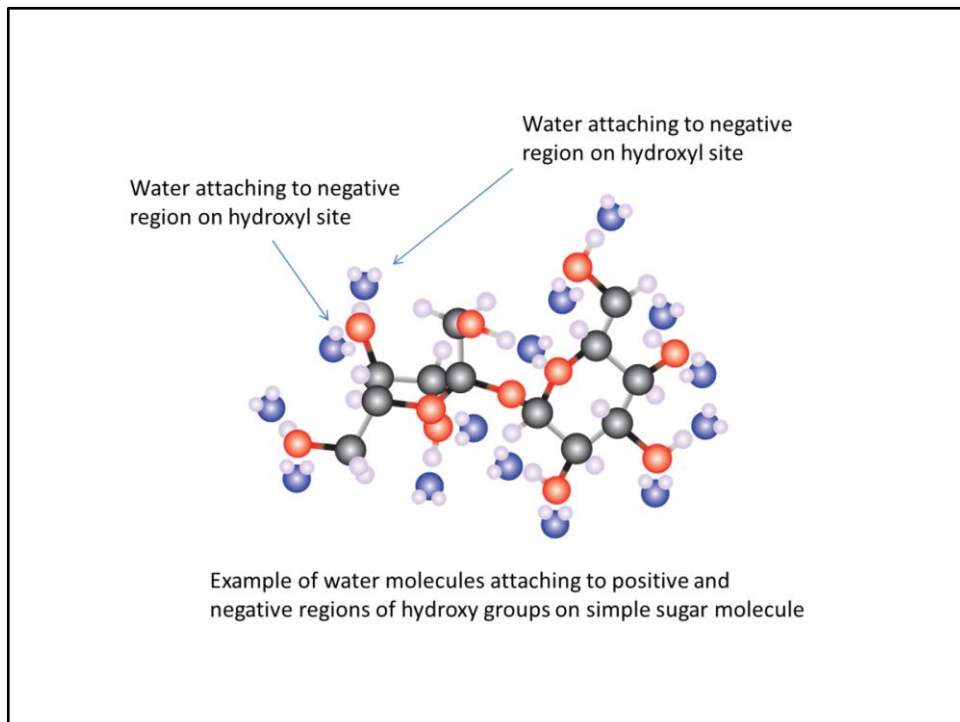
The humectants chemistry has the ability to hold and retain water in the root zones for extended period of time.



Point out to the audience how the hydroxyl groups are located on the “perimeter” region of the humectant molecule that makes them readily available to water molecules for attachment.

It is important that the attachments sites for water are on the outside – In this manner the water that is available even in dry to drought conditions = the water molecules they can hold for future hydration requirements.

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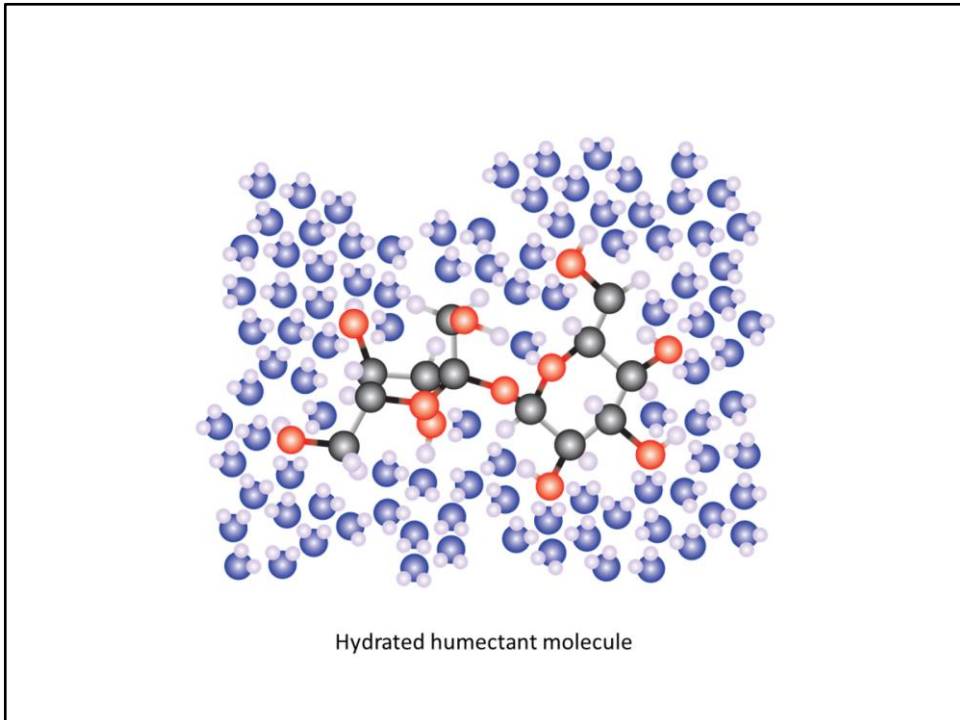


“Here we see the “hydrogen,” positive end of the water molecule being attracted to negative charge of oxygen atom on the hydroxyl group.”

“Conversely, we observe the “oxygen” end of the water molecule being attracted to the positive charge of the hydrogen atom on the hydroxyl group.”

This slides the ability of Cistern either L or G formulation ability to hold water in a “uniform” manner.

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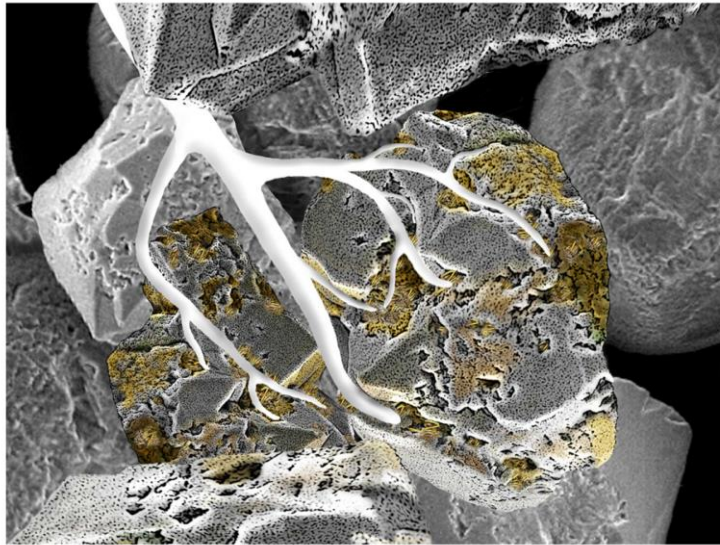


Additional water molecules are attracted to the partially hydrated humectant molecule by cohesion forces – defined as the attraction of water molecules for other water molecules.

This creates a water source for turfgrass as fine roots and root hairs absorb the water clusters via osmosis.

Let's look at how this works in the rootzone.

Click for next slide.

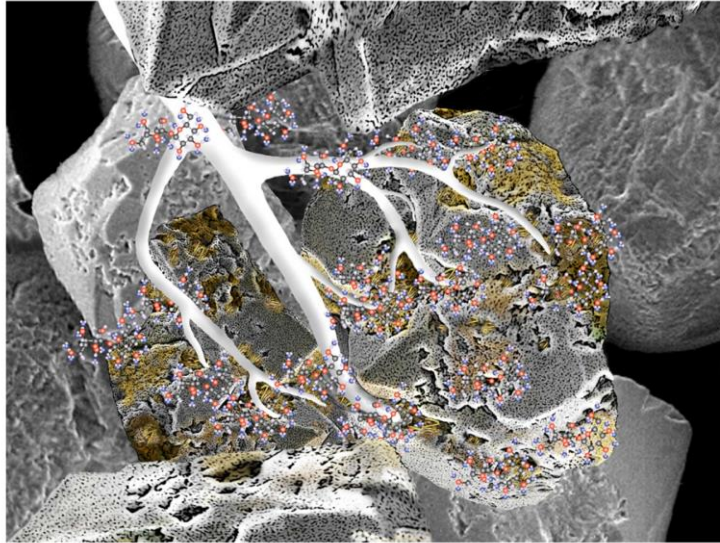


Here we have an illustration of a fine root in a hydrophobic portion of a sand profile.

Water would not normally be attracted in this area (without a soil surfactant or a humectant)

The “humectant molecules is very important because under dry / drought and water / irrigation use restrictions – the Humectant is part of the formulation that holds the water for a longer period of time.

Click

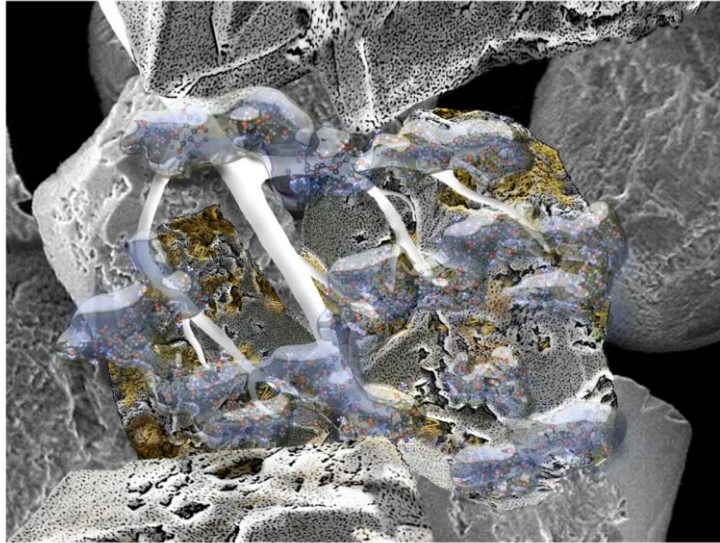


Here we see the deposition of humectants in the area of the fine root.

The humectants begin to attract free water molecules from air spaces and free water molecules that have been pulled of surfaces due to evaporation.

One of the “mode of action” of the Cistern Humectant is to greatly reduce the evaporation of water in puts either rainfall event or an irrigation event – under dry to drought – water restrictions periods = the more water retained / held is a must.

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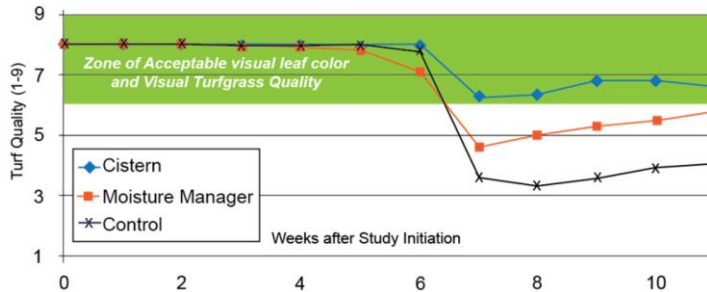


As more water molecules are attracted to the water on the humate molecules, they build to a state that makes previously unavailable water available to turfgrass roots.



NUMERATOR
TECHNOLOGIES, INC.

Managing Turf Quality During Drought or Irrigation Restrictions Turf Quality with 50% Less Water



- Research conducted in greenhouse at Virginia Tech in fall, 2012.
- Treatments applied to creeping bentgrass putting greens plugs at 4 week interval.
- From rating 7 through conclusion Cistern had significantly higher quality than the control.
- Throughout the trial, Cistern proved safe and no burning of grass was observed.

Cistern was applied to bent grass plugs in a greenhouse research trial in 2012 at Virginia Tech University.

The reason for the greenhouse trial research was to make sure there was a drought effect to effectively test the products.

The data proved that Cistern even under 50% reduced water availability could grow quality turf.

The test period was over a 12 week period.

NOTE: Moisture Manager did NOT achieve the level of acceptable turf quality.

2011 JATCO PROJECT
SURFACTANT-REDUCED IRRIGATION ON TURFGRASS

REPORT
January 19, 2012

INVESTIGATOR: John Cisar

OBJECTIVE: *Surfactants aid in uniform 3-dimensional distribution of water thus reducing preferential flow of water past zones of water uptake. Increased efficiency of irrigation will improve water conservation.*

TREATMENTS:

1. 1288 Surfactant at 32oz/A
2. 1288 Surfactant at 64oz/A
3. Untreated control
4. Well-watered untreated control

This slide is from University of Florida research trial by Dr. John Cisar in 2012 Ft. Lauderdale, FL -on Bermuda Grass at 1.5 inch cut , sandy soils and under very dry conditions , very little rainfall happen during the trial period.

NT- 1288 is Cistern L

Data shows that Cistern will improve water conservation.

Untreated control is a true untreated control only moisture applied was by rainfall which was very limited.

NOTE : Number 4 above is Well –Watered Untreated Control – which means those plots got irrigation every day which exceeded 100 % of ET replacement

NOTE: 1 and 2 above got irrigation only to 75 % of ET replacement when needed – measurements on ALL PLOTS was by moisture meters at 1.5 inches in depth.

VISUAL TURFGRASS QUALITY

TRT	3/8	3/16	3/22	3/31	4/1	4/5	4/12	5/10	5/12	5/19
1288 @ 32 oz	7.8	7.5	7.2a	7.2	7.7a	6.8ab	7.6a	7.1ab	6.7a	7.0a
1288 @ 64 oz	7.8	7.7	7.5a	7.5	7.5a	7.4a	7.8a	7.3ab	7.0a	7.0a
WWCHK	7.8	7.6	7.5a	7.3	7.3a	7.2a	7.7a	7.5a	7.0a	7.2a
CHECK	7.7	7.2	6.7b	6.8	6.2b	6.0b	6.8b	6.9b	6.0b	6.6b
Significance	<i>ns</i>	<i>ns</i>	*	<i>ns</i>	*	*	*	*	**	**

ns, *, and ** = $P > 0.10$, $P < 0.05$, and $P < 0.01$

Turfgrass quality ratings based on a 1-10 scale with 10=dark green turf, 1=dead/brown turf, and 6=minimally acceptable turf.

Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.

Both Cistern rates and the Well –Watered Control had good turf quality ratings.
 The Untreated control did NOT have favorable turf quality ratings.
 The weather conditions were very favorable for LDS symptoms.

PERCENT LDS

TRT	3/22	4/5	4/12	5/12	5/19
1288 @ 32 oz	1.7b	4.0b	0.7b	10.4b	2.0b
1288 @ 64 oz	0.0b	4.0b	0.0b	5.0b	1.0b
WWCHK	0.0b	1.7b	0.0b	5.4b	0.0b
CHK	15.0a	20.0a	4.0a	33.0a	10.0a
Signif.	**	**	**	**	*

** and * = $P < 0.01$ and $P < 0.05$

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Percent of LDS was rated –
 Note NO LDS or very low LDS symptoms in the treated plots.

PERCENT VOLUMETRIC WATER CONTENT

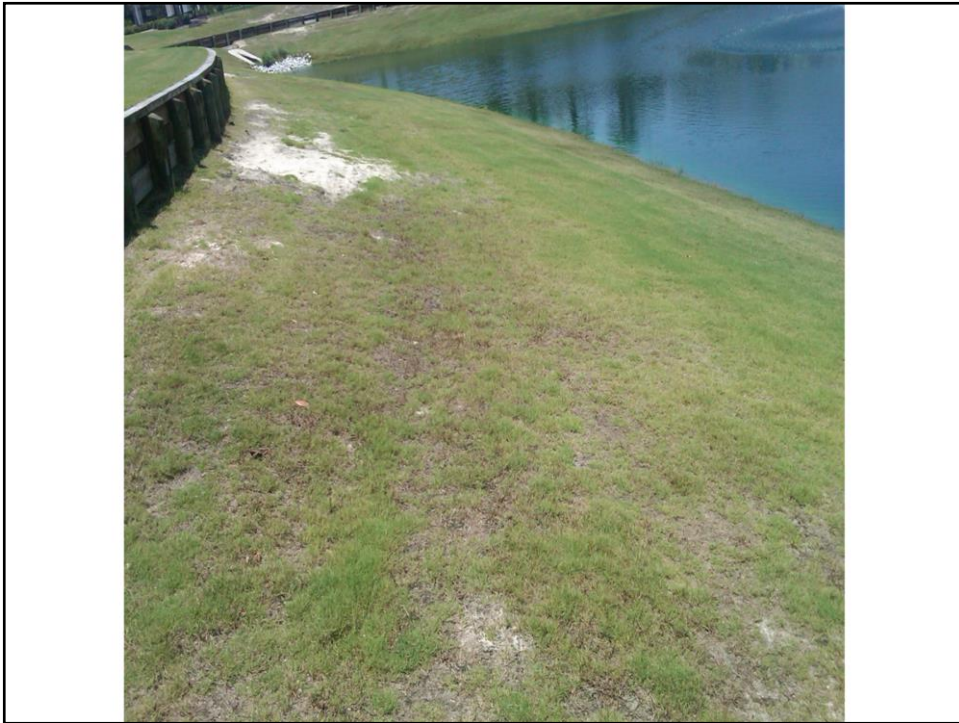
TRT	3/8	3/17	3/31	4/1	4/5	4/12	5/10	5/12	5/19
1288 @ 64 oz	34.7a	32.7	26.7	21.7b	21.6b	32.7a	31.0a	27.9a	30.4
WWCHK	33.7ab	31.3	26.3	26.7a	27.6a	31.3a	35.0a	32.0a	31.0
CHECK	31.7b	30.0	27.3	20.3b	17.3c	27.0b	24.6b	19.4b	27.8
Significance	+	ns	ns	*	**	**	**	**	ns

+, ns, *, and ** = $P < 0.10$, $P > 0.10$, $P < 0.05$, and $P < 0.01$

Means with the same letter within a column are not significantly different according to Duncan's Multiple Range Test.

The most powerful data of the Bermuda Grass research on sandy soils was the moisture meter readings at 1.5 inches.

NOTE: there is no statistical data difference in the two Cistern treatment rates and the Well – Watered Control which got more than 100 % ET replacement everyday!



Cistern Field Demo 2011 Panama City , Florida the day of application. Area treated is an apartment complex. Grass is 419 Bermuda Cistern L was applied at 6 oz. per 1000 sq.. Weather conditions were the area was in a drought condition , no rainfall before the application for two weeks. This area had limited irrigation



Cistern L treated area 14 days later, no rainfall temperatures above 90
F each day
Cistern is safe NO Burn.



Cistern L Field Demo Plot Area not treated



Cistern treated area 14 days later .
Cistern was applied at 6 oz. per 1000 sq. ft. No rainfall during the
evaluation , temperatures were 90 F + for the two week period
NO Burn Cistern is safe .



- Cistern L and G = Can be used for golf applications where there is requirement for “holding” water in the soil profile under drought conditions. Prime examples of Cistern for golf –crowns , mounds ,southwest exposures and high bunker faces.
- Cistern G on a 150 SGN
- Cistern is safe to people, pets and environment

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