Plant Growth Regulator and Soil Surfactant Effects on Drought and Salinity Stressed Bermudagrass and Seashore Paspalum

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Objectives:

1. *Study the effect of a plant growth regulator (PGR) and a wetting agent on turf quality, fall color retention, and spring green–up of Princess 77 bermudagrass and Sea Spray seashore paspalum irrigated with either saline or potable water*
2. *Determine the effect of wetting agents on turf quality and soil moisture distribution in turfgrass rootzones irrigated with either potable or saline water from either a drip or a sprinkler system*

As part of a comprehensive effort to conserve potable water, strategies to reduce or eliminate potable water for golf course irrigation are considered and implemented. First, replacing potable water entirely with recycled or low quality ground water unfit for human consumption would have the largest impact of all measures in reducing potable water used for irrigation. Second, turfgrasses that are adapted to local climates and can survive on less water than traditional turfgrasses can be used. Third, using chemicals such as soil surfactants or plant growth regulators that assist in increasing irrigation efficiency and in lowering evapotranspiration rates (ET) can help in reducing the amounts of water necessary to maintain adequate turf quality.

A study was conducted at New Mexico State University´s Turfgrass Salinity Research Center in Las Cruces, NM (USDA Plant Hardiness Zone 8b) from 2010 to 2012 to investigate the effect of Revolution and Dispatch soil surfactants and Primo Maxx plant growth regulator on performance of drought stressed bermudagrass (Cynodon dactylon cv. ´Princess 77´) and seashore paspalum (Paspalum vaginatum cv. ´Sea Spray´). Irrigated blocks measured 20 feet by 20 feet and were watered from either Toro Precision™ Series Rotating Nozzles (PRN–TA) or from a TORO DL 2000 subsurface drip system with either potable (EC = 0.6 dS m–1, SAR 1.9) or saline ground water (EC = 2.3 dS m–1, SAR = 5.6). During summer and early fall of each year plots were treated monthly with either Dispatch, Revolution, or trinexapac–ethyl (TE, Primo Maxx) according to label rates. A control plot received water only. In order to subject the plants to drought stress irrigation was applied at 50% ET0. Nine soil moisture readings per plot were taken monthly by means of a Time Domain Reflectometer (TDR) (Fieldscout TDR300, Spectrum Technologies, Inc.) 24 hours after an irrigation event. Normalized Difference Vegetation Index (NDVI) readings were collected monthly to substantiate visual quality ratings by means of a Greenseeker. Visual ratings on a scale from 1 (worst) to 9 (best) were collected and photographs were taken biweekly during Summer and Fall.

Visual quality of Princess 77 and Sea Spray irrigated with saline water was always acceptable (equal to or

Figure 1. The effect of Revolution soil surfactant and Primo Maxx plant growth regulator on the performance of drought stressed Princess 77 bermudagrass and Sea Spray paspalum.

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higher than 6.0), regardless of the irrigation system used (Table 1). The visual appearance of plots subsurface drip–irrigated with potable water was better than that of those irrigated from sprinklers in 2012 (Table 1). Visual quality of Princess 77 irrigated with saline water did not differ between irrigation systems throughout the study period. However in 2012, Sea Spray irrigated with saline water from SDI exhibited higher quality than sprinkler–irrigated Sea Spray (Table 1).

Chemical amendments affected chlorophyll and carotenoids content only in bermudagrass but not in seashore paspalum (Table 2). Bermudagrass treated with TE had the highest chlorophyll, carotenoids, and Superoxide dismutase content (Table 2).

Analysis of soil moisture data revealed that Revolution soil surfactant improved water distribution uniformity (lower standard deviation values) on seashore paspalum plots (Table 2). Similar to bermudagrass, soil moisture was more uniform on seashore paspalum plots irrigated with saline water from a sprinkler system when compared to drip–irrigated plots (Table 3). Soil moisture uniformity was greater on plots irrigated from sprinklers and on plots irrigated with saline water compared to plots irrigated from a subsurface drip system or plots watered with potable water, respectively.

Generally, water quality did not affect fall color retention. Seashore paspalum plots treated with trinexapac–ethyl showed darker green color in November than those treated with Revolution or the untreated control. Also, seashore paspalum showed greater fall color retention than bermudagrass regardless of the irrigation system or water quality.

Summary

- Revolution soil surfactant improved soil moisture distribution of seashore paspalum.
- Primo Maxx improved turf quality of drought stressed Princess 77 and fall color retention of Sea Spray.
- Sprinkler irrigated plots showed greater turf quality during first 2 years of the study. However, in 2012 the visual appearance of plots subsurface drip–irrigated with potable water was better than that of those irrigated from sprinklers.

Table 1. Turf quality in 2010, 2011 and 2012 for Princess 77 bermudagrass and Sea Spray seashore paspalum irrigated with either sprinkler (Spr) or subsurface drip irrigation (SDI) in combination with saline (EC = 2.24 dS m^{-1}) or potable (EC = 0.57 dS m^{-1}) water. Quality ratings were taken on a scale from 1 to 9; with 1 = poor quality, dead grass and 9 = excellent, perfect quality. Values represent an average of 60 data points and are pooled over 4 treatments (Control, Primo Maxx, Revolution and Dispatch), 5 months (June to October) and 3 replicates.

	Visual Quality											
	SDI						Spr					
	Potable water			Saline water			Potable water			Saline water		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
Princess 77	6.1c†	6.2bc	6.3b	6.0c	6.4ab	6.4ab	6.6a	6.6a	5.6d	6.1c	6.6a	6.4ab
Sea Spray	6.0c	6.4b	6.9a	6.3bc	6.6ab	6.7ab	6.8a	6.6ab	4.7d	6.4b	6.3bc	6.1c

† Values followed by the same letter in a row are not significantly different from one another (Fisher´s protected least significant difference, $\alpha = 0.05$).

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Table 2. Chlorophyll a+b (Chl) and carotenoids content (μg g^{-1} FW), Superoxide dismutase (SOD) activity in leaves of Princess 77 bermudagrass and soil moisture uniformity (standard deviation of 9 volumetric water content readings taken by a hand-held TDR probe) and fall color retention (assessed visually on a scale from 1 to 9; with 1 = completely dormant/yellow grass and 9 = completely green grass) of Sea Spray seashore paspalum treated either with Trinexapac-ethyl (TE), Revolution, or Dispatch. Values represent an average of 180 data points and are pooled over 2 water qualities (potable and saline), 2 irrigation systems (SDI and sprinkler), 3 years (2010 to 2012), 5 sampling months (June to October) and 3 replicates.

Species	Variable	Control	TE	Revolution	Dispatch
Princess 77	Chl (μg g^{-1} FW)	14.0b	15.7a	13.6b	n/a
	Carotenoids (μg g^{-1} FW)	5.6b	6.0a	5.4b	n/a
	SOD in leaves (units/mg proteins)	26.4b	37.7a	24.7b	n/a
Sea Spray	Soil moisture uniformity	0.36a	0.36a	0.34b	0.37a
	Fall color retention	4.8b	5.5a	4.7b	4.9b

† Values in each row followed by the same letter are not significantly different from one another (Fisher´s protected least significant difference, α = 0.05).

Table 3. Soil moisture uniformity (standard deviation of 9 volumetric water content readings taken by a hand-held TDR probe) in 2010, 2011 and 2012 for Princesss 77 bermudagrass and Sea Spray seashore paspalum plots irrigated with either sprinkler or subsurface drip irrigation (SDI) in combination with saline (EC = 2.24 dS m^{-1}) or potable water (EC = 0.57 dS m^{-1}). Values represent an average of 60 data points and are pooled over 4 treatments (Control, Primo Maxx, Revolution and Dispatch), 5 sampling months (June to October) and 3 replicates. Lower values indicate greater soil moisture uniformity.

	Soil Moisture Uniformity											
	SDI						Sprinkler system					
	Potable water			Saline water			Potable water			Saline water		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
Princess 77	0.47c†	0.62a	0.34e	0.33e	0.52bc	0.23f	0.41d	0.55b	0.24f	0.21f	0.39d	0.15g
Sea Spray	0.51c	0.71a	0.53c	0.47cd	0.65b	0.39e	0.33f	0.50cd	0.26g	0.26g	0.45d	0.20h

† Values followed by the same letter (separately for each grass) are not significantly different from one another (Fisher´s protected least significant difference, α = 0.05)

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