Seashore Paspalum Response to Trinexapac-ethyl and Paclobutrazol

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Abstract. The usage of seashore paspalum (*Paspalum vaginatum* Swartz) as a recreational turf has increased in recent years. On similar species, such as bermudagrass (*Cynodon* ssp.), plant growth regulators (PGRs) are used to decrease mowing frequency. However, no data currently exists for the use of PGRs on seashore paspalum. Therefore, field experiments were conducted over 2 years to determine the effects of trinexapac-ethyl and paclobutrazol on seashore paspalum. Paclobutrazol was non-injurious to turf when applied sequentially, 4 weeks apart, at rates as high as 0.56 kg·ha⁻¹ of a.i. However, these same treatments failed to reduce vegetative growth. Conversely, trinexapac-ethyl treatments produced unacceptable injury (>15%) when applied sequentially, 4 weeks apart, at rates higher than 0.19 kg·ha⁻¹ of a.i. As trinexapac-ethyl rates were reduced to ≤0.14 kg·ha⁻¹ of a.i., injury was reduced to ≤12% while vegetative growth was suppressed to ≥59%, relative to nontreated seashore paspalum. Therefore, trinexapac-ethyl can serve as an effective option for those managing seashore paspalum turf areas. Chemical names used: 4-(Cyclopropyl- α -hydroxymethylene)-3,5-dioxo-cyclohexanecarboxylic acid ethyl ester (trinexapac-ethyl); (+/-)-*R**,*R**- β -[(4-chlorophenyl)methyl]- α -(1,1-dimethylethyl)-1*H*-1,2,4-triazol-1-ethanol (paclobutrazol).

Seashore paspalum is a low-growing, perennial turfgrass that shares many similarities with bermudagrass (*Cynodon* sp.), such as tolerance to low mowing heights (<13mm) (Duncan and Carrow, 2000), wear tolerance (Trenholm et al., 1999), drought resistance (Duncan and Carrow, 2000), and general appearance. However, seashore paspalum possesses additional advantages over bermudagrass, such as lower N requirements (Duncan and Carrow, 2000), superior salt tolerance (Dudeck and Peacock, 1985), and greater ability to grow in low pH soils (Duncan, 1999). These attributes have led many turfgrass managers in the southeastern United States, especially in coastal areas where increased salinity is common, to plant seashore paspalum for sport and recreational areas.

To maintain high quality athletic turf, such as on golf courses, frequent mowing is required. However, frequent mowing is costly and time consuming. Therefore, turfgrass managers have often used plant growth regulators (PGRs) to suppress both vegetative growth and seedhead emergence. Many commonly used PGRs act by interfering with gibberellin biosynthesis, thus reducing cell elongation (Johnson, 1994). A reduction of growth can, therefore, significantly decrease mowing frequency.

Research has shown that a number of PGRs reduce the growth of bermudagrass (Wu et al., 1976; Johnson, 1992a; Johnson, 1994; Fagerness and Yelverton, 2000). When successful,

mowing can be reduced as much as 66% over 12 weeks (Johnson, 1994). However, both bermudagrass injury and growth suppression are often inconsistent. Previous research has shown that this inconsistency is due to temperature during and after the time of PGR treatment (Fagerness et al., 2002). Two commonly used PGRs are trinexapac-ethyl and paclobutrazol. With split applications, trinexapac-ethyl has provided consistent suppression of bermudagrass for 4 weeks (Johnson, 1992a). However, paclobutrazol has been shown to be somewhat less consistent by providing between 1 to 4 weeks of suppression, depending on the bermudagrass cultivar treated (Johnson, 1990, 1992b).

Although the usefulness of PGRs in bermudagrass has been documented in numerous studies, there are no published data on their effects on seashore paspalum. Therefore, the objectives of this research were to determine the tolerance of seashore paspalum to trinexapac-ethyl and paclobutrazol and to quantify their effects on vegetative growth.

Materials and Methods

Studies were initiated in 2000 and 2001 at the Georgia Experiment Station in Griffin, on established seashore paspalum (cv. Sea Isle I). The plot area, measuring 1.5 m × 3 m, was mowed three times per week at a height of 2 cm and irrigated as needed to maintain optimum growth. No additional pesticides were used on the site in either year during the time course of the experiment. The weed population was very low on the experimental site and was removed by hand.

Trinexapac-ethyl (Primo MAXX 1EC) and paclobutrazol (Trimmit 2SC, Syngenta Pro-

fessional Products, Greensboro, N.C.) were applied sequentially, two applications spaced 4 weeks apart, with a CO₂ plot sprayer calibrated to deliver 240 L·ha⁻¹. Treatments were applied in 2000 on 14 July and 11 Aug., and in 2001 on 17 July and 16 Aug. Trinexapac-ethyl was applied at 0.09, 0.14, 0.19, 0.28, and 0.38 kg·ha⁻¹ of a.i., while paclobutrazol was applied at 0.28, 0.42, and 0.56 kg·ha⁻¹ of a.i. Mowing was suspended for 1 d before and after treatment.

Data collection occurred 1, 2, 4, 6, 8, and 10 weeks after the initial application. Turfgrass injury, measured as reductions in color and density, was visually estimated using a 0 to 100 scale, where 0 represents no injury and 100 represents plant death. Clippings were also collected from a 1.3-m² area with a reel mower (Toro Greensmaster 1600, Toro Co., Commercial Division, Bloomington, Minn.) equipped with a grass clippings catch basket every 2 weeks, over a 10-week period. Harvested material was air dried at 70 °C for 4 d to quantify vegetative growth after treatment. Clipping dry weights were converted to percent dry weight reduction or increase (+) relative to the untreated control plots.

The same experimental area and treatment randomization was used in 2000 and 2001. Therefore, the same treatments were applied to the same areas in both years. The experimental design was randomized complete block with three replications. Significant treatment × year interaction was not detected for either clipping weight or turf injury; therefore, data were pooled across years. Analysis of variance (ANOVA) was conducted and means were separated using Fisher's protected least significant difference (LSD) ($P \leq 0.05$).

Results and Discussion

The trinexapac-ethyl treatments were more injurious than paclobutrazol even at the lowest rates (Table 1). The higher level of injury was related to yellowing of foliage and a reduction in density. Quality became unacceptable (>15%) when trinexapac-ethyl rates were ≥0.19 kg·ha⁻¹ of a.i. When trinexapac-ethyl was applied at 0.19, 0.28, and 0.38 kg·ha⁻¹ of a.i., seashore paspalum injury was 12%, 14%, and 18%, respectively, 4 weeks after the initial treatment. When the second application at the same rates occurred, injury increased to 22%, 30%, and 31%, respectively, 8 weeks after the initial treatment. Therefore, sequential applications of trinexapac-ethyl at rates exceeding 0.19 kg·ha⁻¹ of a.i. are inadvisable due to excessive seashore paspalum injury. Fagerness and Yelverton (2000) have also shown minimal injury when trinexapac-ethyl was applied at rates lower than 0.19 kg·ha⁻¹ a.i. to bermudagrass. However, paclobutrazol, when applied sequentially at the highest rate (0.56 kg·ha⁻¹ of a.i.), did not injure seashore paspalum. Johnson (1994) showed that repeated application of paclobutrazol was generally less injurious to bermudagrass when compared to trinexapac-ethyl.

Paclobutrazol has been documented to decrease vegetative growth of bermudagrass up to

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Table 1. Influence of trinexapac-ethyl and paclobutrazol on seashore paspalum injury and vegetative growth suppression.

Treatment	Rate ^y (kg·ha ⁻¹ a.i.)	Turf injury, WAIT ^z						Dry wt reduction of clippings, WAIT				
		1	2	4 ^x	6	8	10	2	4	6	8	10
		-----%-----						-----% of untreated control-----				
Trinexapac-ethyl	0.09 fb ^w 0.09	3	7	3	7	8	6	53	40	67	64	59
Trinexapac-ethyl	0.14 fb 0.14	5	13	3	9	12	9	55	52	79	77	69
Trinexapac-ethyl	0.19 fb 0.19	8	18	12	14	22	21	75	74	85	90	87
Trinexapac-ethyl	0.28 fb 0.28	9	23	14	18	30	21	75	80	91	95	94
Trinexapac-ethyl	0.38 fb 0.38	10	26	18	18	31	28	78	86	94	96	96
Paclobutrazol	0.28 fb 0.28	2	1	0	1	0	0	+10	7	10	+2	2
Paclobutrazol	0.42 fb 0.42	2	1	0	1	0	0	+10	5	10	+3	3
Paclobutrazol	0.56 fb 0.56	3	1	0	2	0	0	+21	2	15	+12	+8
LSD _{0.05}		3	2	4	4	7	7	17	16	20	13	18
<i>Analysis of variance</i>												
PGR		*	*	*	*	*	*	*	*	*	*	*
PGR × year		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

^zWAIT = weeks after initial treatment.^yTrinexapac-ethyl and paclobutrazol were applied at indicated rate twice, spaced 4 weeks apart.^xTiming of second PGR application.^wfb = followed by.NS = *Nonsignificant or significant at $P \leq 0.05$.

27% after 7 weeks (Johnson 1992b). However, vegetative suppression of seashore paspalum growth with paclobutrazol was generally not statistically different from the nontreated control (Table 1). From these data, paclobutrazol was determined to have only a minor effect on seashore paspalum growth. Conversely, sequential applications of trinexapac-ethyl at rates ≥ 0.19 kg·ha⁻¹ of a.i. reduced vegetative growth between 87% and 96%, 10 weeks after treatment (Table 1). Therefore, trinexapac-ethyl applied at higher rates is highly effective with almost no growth of seashore paspalum for a period of 10 weeks. Although these high levels of suppression are desirable, it was these same treatments that increased turfgrass injury over 15%. Consequently, trinexapac-ethyl applied sequentially at lower rates, 0.09 to 0.14 kg·ha⁻¹ of a.i., reduced vegetative growth 64% and 77%, respectively, 8 weeks after treatment with minimal injury ($\leq 12\%$). Injury caused by trinexapac-ethyl applications (0.11 kg·ha⁻¹ of a.i.) have also been shown to not to injure bermudagrass (Fagerness et al. 2002). Trinexapac-ethyl was most effective in reducing seashore paspalum vegetative growth and least injurious

when applied sequentially at rates equal to, or below, 0.14 kg·ha⁻¹ of a.i.

Paclobutrazol applied at rates ≤ 0.56 kg·ha⁻¹ of a.i. was less injurious, but also less effective at reducing vegetative growth, than trinexapac-ethyl when applied to seashore paspalum. Trinexapac-ethyl reduced vegetative growth more than 56% at all rates, 10 weeks after treatment, and at rates ≤ 0.14 kg·ha⁻¹ of a.i. caused only minimal levels of injury. Therefore, trinexapac-ethyl could be a useful management tool for seashore paspalum turfgrass managers by reducing clippings as well as mowing frequencies.

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