Warm-season Turfgrass Adaptation in Northern Italy

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Introduction

A number of experimental trials have shown that some warmseason grasses are well adapted to Mediterranean climate (Volterrani et al., 1997) and their benefits have been experienced in Italy by a number of recent applications in sport fields, golf courses and residential lawns. Being Italy a transition zone for turfgrasses, after their introduction in the warmest regions, to define the northern limit for their successful use, is a major goal of the Italian research on turfgrasses. Therefore the aim of this trial was to evaluate the adaptability of some warm-season turfgrass species and cultivars to the latitudes of northern Italy.

Materials and methods

The trial was carried out during 2004-2007 at the Montecchia Golf Club in Padua (45°42'N, 11°86'E) on a clay-loam soil. The following turfgrass species and cultivars were evaluated: *Cynodon dactylon* (L.) Pers. (*Cd*) cv 'Princess 77', *Cynodon dactylon* × *transvaalensis* Burtt. Davy (*Cdxt*) cv 'Tifway 419', *Eremochloa ophiuroides* (Munro) Hack (*Eo*) cv 'Tifblair', *Paspalum vaginatum* Swartz (*Pv*) cv 'Salam', *Pennisetum clandestinum* Hochst ex Chiov. (*Pc*) cv 'AZ1', *Zoysia japonica* Steud. (*ZjE*) cv 'El Toro', *Zoysia japonica* Steud. (*ZjZ*) cv 'Zenith', *Zoysia matrella* (L.) Merr. (*Zm*) cv,'Zeon'. Seeding rates were: 5 g m^{-2} for *Eo* and *Pc*, 10 g m^{-2} for *Cd* and *ZjZ*. For vegetatively propagated species, *Cd×t*, *Pv, ZjE* and *Zm* sprigging rate was 2 l m^{-2}. Species were sowed or sprigged on June 28 2004, and a randomised block experimental design was adopted with 4 replications in 6 m^2 (2 x 3 m) plots. During 2004 a total of 130 kg ha^{-1} of N and 65 kg ha^{-1} of both P_2O_5 and K_2O were applied. During 2005-2007 a yearly total of 180 kg ha^{-1} of N, 28 kg ha^{-1} of P_2O_5 and 140 kg ha^{-1} of K_2O were distributed. The following evaluations were carried out: ground cover during establishment; spring green-up; fall color retention; turfgrass quality (1 = poor, 9 = high). In 2005 fall, the following parameters were measured: leaf blade width; shoot density; total rhizome-stolon length per unit area.

All data were subject to ANOVA and LSD for $P \leq 0.05$ was used to detect differences between means.

Results and discussion

The fastest-establishing species were the bermudagrasses, and in particular 'Tifway 419' that reached 100% ground cover after 50 days from sprigging, while the zoysias only achieved complete ground cover during the following year (2005) (data not shown). However, the zoysias showed a considerably superior color retention during fall 2004 (data not shown). Despite reaching full ground cover at the end of the first vegetative season, *Pv* and *Pc* suffered from winter injury that was evident in the following spring 2005 with significant levels of damage being observed (data not shown). The following winter (2005-2006) both species died.

Cynodon spp. The vegetative propagated *Cdxt* showed a far higher green cover percentage compared to seeded cultivar (Table 1). Both cultivars showed a fine leaf texture (0.9 mm) and an high shoot density (Table 2). 'Tifway 419' showed higher values for the total rhizome-stolon length per unit area and better quality compared to 'Princess'.

Zoysia spp. In Spring 2006, vegetatively propagated zoysias showed a lower green cover percentage (Table 1), which can be ascribed to a more severe winter climatic conditions (data not shown). 'Zeon' showed a finer leaf texture (1 mm), a more than double shoot density (7.5 shoots cm^{-2}) and a higher rhizome-stolon length per unit area (5.6 cm cm^{-2}) compared to 'El Toro' and 'Zenith' (Table 2). *Zm* turfgrass quality was consistently above 8. Among the japanese zoysiagrasses, cv 'El Toro' showed a higher rhizome-stolon

length per unit area (3.7 cm cm^{-2}) compared to cv 'Zenith' (1.8 cm cm^{-2}).

Table 1. Comparative spring green-up, fall color retention and turfgrass quality among species and cultivars during the trial period.

Species	Cultivar	Spring Green-Up			Fall Color Retention			Turfgrass Quality		
		Percent Green Color						(1 = poor and 9 = best)		
		2005	2006	2007	2005	2006	2007	2005	2006	2007
Cd [1]	Princess 77	5	14	30	55	22	50	5.0	4.4	5.1
Cdxt [2]	Tifway 419	66	56	46	57	32	50	6.4	7.3	6.4
Eo [3]	Tifblair	33	64	78	60	45	65	6.3	7.0	7.1
ZjE [4]	El Toro	63	53	73	91	55	93	7.1	7.3	7.1
ZjZ [5]	Zenith	65	66	74	37	60	95	6.6	7.4	7.0
Zm [6]	Zeon	73	45	65	90	62	99	8.9	8.5	8.8
LSD $_{0.05}$		*8*	*10*	*13*	*5*	*11*	*8*	*0.8*	*0.6*	*0.8*

[1]Cd = Cynodon dactylon; [2]Cdxt = C. dactylon x *transvaalensis; [3] Eo = Eremochloa ophiuroides; [4] ZjE = vegetatively propapated Zoysia japonica; [5] ZjZ = seed propagated Zoysia japonica; [6] Zm = Zoysia matrella*

Eremochloa ophiuroides Except for the year 2004, centipedegrass showed a prompt spring green-up and acceptable fall color retention. Leaf texture was coarse (2.8 mm), shoot density was the lowest observed in the the trial cultivars (1.6 shoots cm^{-2}) and rhizome length per unit area was similar to *Cdxt* and *ZjZ*. Turfgrass quality was always acceptable.

Table 2. Comparative turfgrass characteristics among species and cultivars determined in 2005.

Species	Cultivar	Leaf Blade Width (mm)	Shoot Density (n° cm^{-2})	RSL [7] (cm cm^{-2})
Cd [1]	Princess 77	0.9	4.6	0.5
Cdxt [2]	Tifway 419	0.9	4.7	1.3
Eo [3]	Tifblair	2.8	1.6	1.4
ZjE [4]	El Toro	2.3	3.2	3.7
ZjZ [5]	Zenith	2.3	3.0	1.8
Zm [6]	Zeon	1.0	7.5	5.6
LSD $_{0.05}$		*0.2*	*1.3*	*1.2*

[1]Cd = Cynodon dactylon; [2]Cdxt = C. dactylon x *transvaalensis; [3] Eo = Eremochloa ophiuroides; [4] ZtE = vegetatively propapated Zoysia japonica; [5] ZjZ = seed propagated Zoysia japonica; [6] Zm = Zoysia matrella;* [7] RSL = Rhizome and stolon total length per unit area

Conclusions

The species that showed the best adaptation to the trial environment of northern Italy were the zoysiagrasses and the bermudagrasses, with the vegetatively propagated cultivars faring generally better than seeded ones, in accordance with the findings of Croce et al. (2001) in other Italian sites. Centipedegrass was particularly interesting, given its good turfgrass quality. *Paspalum vaginatum* and *Pennisetum clandestinum* demonstrated their non adaptability to the winter temperatures associated with the trial latitude.

Literature cited

Croce, P., De Luca, A., Mocioni, M., Volterrani, M. and Beard, J.B., 2001. Warm-season turfgrass species and cultivar characterizations for a mediterranean climate. Intl. Turfgrass Soc. Res. J. 9:855-859.

Volterrani, M., Grossi, N., Pardini, G., Miele, S., Gaetani, M. and Magni, S. 1997. Warm season turfgrass adaptation in Italy. Intl. Turfgrass Soc. Res. J. 8:1344-1354.