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ADAPTABILITY OF WARM SEASON TURFGRASS SPECIES AND CULTIVARS IN A MEDITERRANEAN CLIMATE

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ABSTRACT

In all the Mediterranean area the limited water availability is major developing concern. Traditionally cool season grasses have been used in Italy for establishing high maintenance turfgrasses. The objective of this study was to evaluate the adaptability of five warm season grass species to the Mediterranean environment in Italy, from the point of view of brown cover, color, seeding production and root biomass. For the first two aims a total of 31 cultivars of *Cynodon, Zoysia, Paspalum vaginatum, Stenotaphrum secundatum* and *Buchloe dactyloides* have been investigated. For seeding and root biomass production a total of 30 cultivars have been tested.

The trial was carried out over a five year period for the turfgrass quality and over a 1 year period for dormancy length. Cultural practices have been maintained to represent the standard maintenance of golf course fairways with the exception of *Buchloe dactyloides* and *Stenotaphrum secundatum* cultivars. The experimental site was just west of Rome near Casalpalocco, Italy. The results of the study revealed the vegetatively propagated cultivars performed better than seeded cultivars in terms of turfgrass quality and seedheads production. , but also in terms of color retention. Brown cover has more variability among cultivars.

Some *Zoysia* cultivars have had a very good color retention during the fall and winter as well as a limited dormancy lenght. *Buchloe dactyloides* did not adapt at the Mediterranean climate under these experimental conditions. *Stenotaphrum secundatum* performed well and could be used in Mediterranean climate for producing low maintenance turfgrasses.

Key Words: brown cover, color retention, leaf blade width, mole crickets, seeded, shoot density, turfgrass quality, vegetative,

INTRODUCTION

It is a tradition that the C_3 cool-season grasses are used for turfs in the Mediterranean climate of Italy, as well as in many other countries surrounding the Northern Mediterranean Sea. The most of these turfgrasses cultivars are imported from Northern Europe especially from U.K. Netherlands and Germany. A possible reason to this situation is the fact that vegetative production sources for warm-season cultivars coming from U.S. are not allowed in Europe.

However, the general climatic conditions of the Mediterranean regions, characterized by low rainfall from May to October, along with an increasingly limited water supply are dictating the need to use the low water use rate, drought tolerant warm-season turfgrasses. Among the warm-season turfgrasses, the *Cynodon* species and *Paspalum vaginatum* are characterized by superior drought resistance and dehydration avoidance, which are related to extensive deep root systems (Beard, 1989; Beard and Sifers, 1997). Not all the species and cultivars tested anyway, have shown the same winter color retention and dormancy. According these two characteristics, the objective of this research was to assess the turfgrass performance and adaptation of five species and a total of 31 cultivars of C_4, warm-season turfgrass species under Mediterranean climatic conditions in Italy.

A limited winter dormancy together with a sufficient color retention could represent an

important step in order to establish warmseason grasses in Italy.
In any case this objective can be more easily reached trough a winter overseeding program in those areas where green winter turfs are desired, such as on sports fields and resort destination golf courses (Beard, 1973 and Beard, 1982, Volterrani et al. 2001).

MATERIALS AND METHODS

Establishment.

The experimental site was just west of Rome near Casalpalocco, Italy, at 41°40 N and 10°15'E. The sea cost of Tirrenian Seawas very closed, at about 2 km. The plot size was 3,0 by 2,0 m, in a randomized block design with 4 replications. There was a 0.5 m bare-soil alleyway between each plot. The native root zone was composed of 83.5% sand with 95% above 0.25 mm in diameter, 10.8% silt, and 5.7% clay. The infiltration rate was 89 mm h^{-1}, and the organic matter content was 4.7%. . For all the investigations the *Cynodon* L. C. Rich. entries included 11 seeded and 5 vegetative cultivars, the *Zoysia* Willd. entries included 4 seeded and 5 vegetative cultivars, the *Stenotaphrum secundatum* entries included 2 vegetative cultivars, the *Buchloe dactyloides* [(Nutt.) Engeln.] entries included 3 seeded cultivars and for *Paspalum vaginatum* Swartz entries just one cultivar. The 5 hybrid *C. dactylon* x *C. transvaalensis* included Santa Ana, Tifdwarf, Tifgreen, Tifway, and Tifway II, with the other 11 cultivars being *C. dactylon* [(L.) Pers.] var. *dactylon*. Among the *Zoysia* species *Z. japonica* Steud. is represented by Chinese common, El Toro, J-36, Meyer, T-1 Meyer, and W 3-2. De Anza and Victoria are hybrids of *Z. japonica* x *Zoysia* species, while Emerald is a hybrid of *Z. japonica* x *Z.matrella* var. *tenuifolia.*

The site was tilled, and phosphorus and potassium were incorporated into the seedbed at rates based on a chemical soil test. The soil pH was 7.1. The site was fumigated with methyl bromide on 14 July 1995. The planting date for the seeded cultivars was 21 July 1995, and for the vegetatively planted cultivars it was 17 August 1995, with the exception of a few entries which were planted on 5 August 1996. These included the seeded W 3-2 and the vegetatively planted Santa Ana. The vegetative plantings were sprig planted in rows, followed by rolling to firm the soil around the lateral stems. The seeding rate was at 0.5 kg 100 m^{-2} for the *Cynodon* cultivars, 1 kg 100 m^{-2} for the *Zoysia* cultivars, and 0.5 kg 100^{-2} for the *Buchloe* cultivars.

Cultural Practices.

Initially (all the first year of establishment) turfs were mowed twice per week at a cutting height of 50 mm using a triplex reel mower. For subsequent growing season, the cutting height was lowered to 13 mm, with a mowing frequency of 2 to 3 times per week, depending on the vertical shoot growth rate. Irrigation program has been adapted according soil temperature and evapotranspiration rate, but supplemental irrigations were applied as needed to prevent visual wilt of the turf. A total of 2.41 kg 100/ m^2 of nitrogen was applied during the 1996 growing season, divided into 4 equal applications. In 1997 the annual nitrogen fertilization rate was 1.53 kg / 100 m^2, divided into 5 equal applications, and in 1998 thru 2000 it was 2.25 kg/ 100 m^2, divided into 5 equal

applications. The two exceptions to this nitrogen fertilization program were the *B. dactyloides* cultivars that have received a total of 0.5 kg / 100 m^2 of nitrogen in 2 equal applications. Phosphorus and potassium were applied twice annually as needed based on a chemical soil test. Invading weeds were allowed to invade, except the establishment period where they were manually removed. No turf cultivation or vertical cutting was practiced on the experimental area in order to avoid interplot contamination. Some occasional, sporadic disease injury were evident in the turfed plots, while a significant mole cricket infestation occurred in 1999 and 2000.

Assessments.

Both turfgrass quality and morphological assessments were made during the 1996 thru 2000 seasons. Visual turfgrass quality estimates were made at 15- to 30-day intervals throughout the growing season. These ratings were based primarily on a composite of two components: uniformity of appearance and shoot density. The rating scale used was 9 = best and 1 = poorest. A rating of 6.5 or higher represented an acceptable quality turf surface for golf fairways, sports fields, and high-quality lawns.

Visual assessments for seeding production and turf color were made in 1996 (first of October), dormancy duration has been measured in days during the fall winter time of 1996 / 1997. For this last assessment we have considered the number of days in which brown cover percentage is more than 50 %.

The data were processed and statistically analyzed using analysis of variance.

RESULTS

Brown cover

The analyzed data indicate there is no difference in dormancy duration between propagated hybrid *Cynodon* cultivars and seeded cultivars. On the contrary *Zoysia* propagated cultivars have a significant less dormancy period than seeded cultivars. Victoria performed very well showing a good color retention trough all the winter time. *Buchloe dactyloides* cultivars have obtained the worst results with more of 5 months of dormancy.

Seeding production

From this point of view *Cynodon* propagated cultivars showed a very limited seedheads production correlated to seeded cultivars. Same result has been obtained by *Paspalum vaginatum cv Adalayd.* No variation has been observed among *Zoysia* cultivars which showed almost no seedheads at all. Between the two *Stenotaphrum* cultivars, *Floratan* has performed quite well.

Root biomass

There is no significant variation among species with the exception of *Paspalum vaginatum cv. Adalayd* and *Cynodon Tifgreen* with the best result and *Zoysia* cultivars with the worst.

Color
At the time of the test, best performance has been obtained by *Paspalum vaginatum Adalayd* with a very dark green / blue color. *Cynodon* hybrids were performing quite well, a little bit better than *Zoysia* hybrids. *Stenotaphrum secundatum cv Floratan* also performed very well.

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