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Characteristics of Some Warm Climate Grass Plants Commonly Used in Green Field Plant

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Abstract: The aim of this study is to investigate the characteristics of Cynodon, Zoysia and Paspalum genera and species, which are widely used in multi-purpose turf field facilities in temperate climate zones. All of these varieties are defined as warm climate grass. The genus Cynodan includes the most widely used species, especially with its resistance to high temperatures. Compared to other hot climate grass plants, Zoysia is successfully used in the formation of green areas with species that have very good shade tolerance and low temperature tolerance. Paspalum includes species that stand out with their resistance to salinity, drought and oppression, and it is successfully applied in erosion control as well as creating turf fields for different purposes.
Keywords: *Turf, Cynodon, Zoysia, Paspalum, characteristics*

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1. INTRODUCTION

The global water crisis and the increase in temperature have now become a common problem for all countries. For a livable world, all societies must act together and implement urgent environmental action plans. The World Economic Forum states that the water crisis is one of the three biggest global risks since 2012. The most significant impact of water scarcity has been on the agriculture sector, which accounts for 70% of global freshwater resources (Food and Agriculture Organization of the United Nations [FAO], 2012). Pollution of existing freshwater resources and irregularities in precipitation patterns strain the water resources needed for the growing world population, limiting the availability of irrigation water for the turf industry and increasing the need for drought-resistant varieties. This need has made the use of warm climate grass plants widespread in the greenfield facility, especially in the regions located in the temperate climate zone. The stress and ability of a plant to survive water deficiency is called drought resistance (Levitt, 1980). Grass plants contain 75-85% water by weight (Beard, 1966) and begin to wilt with a 10% reduction in water content (Beard, 1973).

In the Mediterranean coasts of Italy, France and Spain (Miele et al., 1995) and in the states of California, Arizona, Texas, which form the Mediterranean climate-like belt of the USA (Duncan and Carrow, 2007), successful and sustainable green areas are created by using grass species such as *Cynodon dactylon, Zoysia japonica, Paspalum vaginatum, Paspalum notanım, Pennisetum clandestinum, Stenotaphrum secundatum*. The aforementioned grasses are preferred according to their usage areas (Martiniello and Andrea, 2006) and are used for grassing sports fields (football, tennis, baseball, golf, etc.). In this preference, the herbs in question, besides their superior resistance to heat and drought stress, compared to cool climate grass plants, the capability of performing two times more photosynthesis while using much less water under the same conditions, which plays a fundamental role. This is the basis of grass plant breeding studies that have been carried out for many years. (Hubbard, 1987; Gibeault et al., 1989; Goatley et al., 1994; Cockerham et al., 1998; Zhou and Abaraha, 2007; Geren et al., 2009). Today, species belonging to the Cynodon, Zoysia and Paspalum genera are successfully and widely used in lawn planting, especially in the hot climate zone. In this review, the main characteristics of the main grass species of the mentioned genera will be explained.

2. CYNODON

Bermuda grass (Cynodon (L.) Rich) has higher drought and temperature tolerance and fewer disease and pest problems than most grass species in tropical and warm climates. In addition to these features, it is a type of grass that is frequently used in sports fields, golf courses, parks, home gardens and other green area arrangements due to its very good resistance to pressing and chewing (Beard, 1973).

2.1. *Cynodon dactylon* (L.) Pers.

Bermuda grass creates a very dense, strong and dense layer of turf. Since the leaf blades are narrow in width, they form a thin, very thin or medium textured structure, the color varies from very light green to dark green, while the growth takes place in a completely horizontal form with stolons and rhizomes. The root system is fringed, dense and quite deep. While the production of all Bermuda types is carried out vegetatively with plucked or cut cuttings and rooted cuttings, only Bermuda grass can be produced with its seeds, which cover the area where it is applied in a short time with their rapid development (Emmons, 2000; Christians, 2004). Since Bermuda grass is adapted to temperate-rainy and temperate-semi-arid climates, it is extremely resistant to heat and drought but very sensitive to cold. For this reason, it enters the dormant period to protect itself from the winter cold and turns completely yellow. This yellowing and dormancy begin when the soil temperature drops below 15 °C and end when it rises above this temperature again in the spring, and plant growth resumes. The shade tolerance of the plant, which loves the light very much, is almost nonexistent (Avcıoğlu, 2014). Bermuda grass, which can adapt to a wide variety of soil conditions, achieves its highest performance in fertile, relatively loose, well-drained soils; however, the coarse (sandy) soil structure gives negative results due to the lack of nutrients. The plant is also resistant to water accumulation, salinity and soil acidity conditions of pH: 5.5–7.5 (Uzun, 1999). Bermuda grass, which forms a very dense, uniform and high quality green cover under suitable conditions, is successfully used in parks, sports fields, athletic fields, home gardens, road slopes and golf areas due to its rapid regrowth feature in temperate climates such as the Mediterranean climate (Duble, 2013). This feature of it gives the most positive results in sports fields, even if the vegetation, consisting of partially dead stems and leaves, is damaged, sports can be done for a long time on the yellowed vegetation in winter. Because in the spring, Bermuda grass can cover the area again and quickly. In order to create a more balanced green cover on sports fields, Bermuda grass can also be grown mixed with cool-climate grass plants. Another technique used to give the sports fields of Bermuda grass, which turns yellow during the winter period, a green appearance in this period; top seeding and some cool climate grasses (perennial grasses), which are sprinkled on the yellowed vegetation at the end of summer. The area is covered with a green cover throughout the winter (Avcıoğlu, 2014). Practices have shown that this type of grass requires moderate and, depending on the situation, intensive care. 1.25-2.50 cm cutting height is best because it is resistant to cutting from the bottom and good vegetation is provided with dense cutting. Some varieties of Bermuda grass can even withstand being mowed every day at a height of 0.5-0.65 cm (Emmons, 2000). Bilgili et al., 2017 say that mats and bald spots can be avoided by giving Bermuda grass, which grows well with water and fertilizer, an average of 4 kg/da of nitrogen each month and cutting it deep.

2.2. *Cynodon transvaalensis* Burtt-Dawy

The common name of Uganda grass, which has successful application areas in the Mediterranean climate zone, is African Bermuda grass (Taliaferro, 2003). Uganda grass, which has a finer structure and slower growth than Bermuda grass, produces good results, particularly in hot climate sports fields (Cockerham, 2008).

3. ZOYSIA

Grown in temperate rainy and transitional climate zones, Zoysia produces a uniform, dense, short, high-quality green grass cover, while its growth rate is low. There are differences in leaf color and texture according to species. The leaves and stems are very rough and hard, making shaping difficult. Zoysia species spread horizontally with hard, strong stolons and rhizomes, this dense and strong vegetation prevents foreign plants from entering the area and is very durable (Ntoulas et al., 2013).

3.1. *Zoysia japonica* Steud

Z. japonica (japanese grass) is the most commonly used species in the genus Zoysia (Braun, 2011). Among the warm climate grass species, Japanese grass, which has the best tolerance to low temperatures in winter, retains its color in winter longer than other types. If the temperature drops below 10-15 °C, it enters dormancy and turns yellow, turning brownish white throughout the winter (Avcıoğlu, 1997). Due to its good shade tolerance compared to other warm climate grass types, Japanese grass is also a suitable choice for use in turf areas with penumbra conditions that do not receive full sun (Wherley, 2011). The root system of Japanese grass is strong and fringed at medium depth. Because it produces a limited number of seeds, it is usually propagated by rooted and rootless cuttings as a spread planting method. Since the growth rate of the shoots is very slow, Japanese grass covers the plots very slowly, and the damage to the vegetation can be removed very slowly (Avcıoğlu, 2014). The hard and strong stem and leaf structure greatly increases the resistance of the green areas formed by this plant to pressing and crushing, Japanese grass, which has a very good resistance to salinity, can adapt to different soil types, in heavy and fertile soils with a pH of 6-7 and high drainage, it gives the best results by applying 2,5-5 kg/da nitrogen fertilizer monthly and mowing at a height of 1.25-2.5 cm (Avcıoğlu, 1997). With these features, Japanese grass is used in areas such as home gardens, playgrounds, parks, horse racing and athletic tracks, which are intensively used in the states of the USA with a temperate climate zone, Japan, Korea, Australia and the Mediterranean zone of our country (Boyd et al., 2003). It is resistant to diseases and pests compared to many green-field grasses. Sometimes helminthosporium, nematodes, gray worms, rust and leaf spots can cause significant damage. Japanese grass is also highly tolerant of herbicides such as Simazin and Atrazine. Many varieties and types of Japanese grass are available in commercial markets (Avcıoğlu, 2014).

4. PASPALUM

Pistachio (*Paspalum* sp.) is found in natural vegetation with approximately 400 species in countries in the subtropical belt of North and South America, such as Brazil, Argentina, Cuba, Uruguay, Paraguay (Pessarakli ve Kopec, 2007).

4.1. *Paspalum vaginatum*

In recent years, it has been determined that *Paspalum vaginatum* of the Paspalum genus, which has been examined in all aspects with the intensive studies of breeders, is resistant to extreme salinity and shows superior grass performance, and as a result of intensive breeding studies, very effective varieties have been bred and presented to the consumer (Pessarakli ve Kopec, 2007). *Paspalum vaginatum* varieties can withstand water-saturated soil conditions under rain for 250–300 days, can stay under water for days, and can be irrigated with treated wastewater. When sea water is used in irrigation, it has a "herbicide" effect on *Paspalum vaginatum* plots. This grasshopper, which can form shoots as small as 2.5 cm, also has a highly competitive performance. It has higher shade and drought tolerance than other hot climate grasses. It can be cut up to 3-4 mm stubble height (Avcıoğlu, 2014). Paspalum vaginatum has a variety of uses in the grass industry. Due to its leaf texture, quality and resistance to printing, it contains properties suitable for many different applications. Golf course applications, sports field applications, residential and landscape areas and erosion control can be counted among these. Under appropriate care conditions, salted pseudo-millets outperform other warm climate grasses in terms of resistance to multi-directional pressures (drought, salt, water ponding, low light intensity, extremely high and low pH).

4. 2. *Paspalum notatum* Flugge

This perennial grass species, resistant to adverse conditions, adaptable to mild-rainy and temperate-arid climates, gives the best results in sandy soils in the coastal belt (Nelson et al., 1993). *Paspalum notatum*, which forms a dense vegetation with its horizontally growing thick rhizomes and relatively deep roots, can grow in almost any type of soil and is based on a dense form. This type of grass, which can be produced with seeds or rhizomes, is very successful only on road slopes, airports and areas where soil protection measures are required due to its coarse texture (Avcıoğlu, 1997).

4. 3. *Paspalum dilatatum* Poir.

It is an important pasture plant and fodder plant in the hot climates of the world and has the characteristics of being resistant to heat, drought and cold by adapting to temperate-rainy climates (White et al., 1975; Jones, 1985). *Paspalum dilatatum* is also called "water grass" because it loves water. It is produced by seeds and has proven to be effective in erosion control. Since *Paspalum dilatatum* is stronger than Bermuda grass in terms of resistance to adverse conditions, it provides successful lawn formation in mixed plantings (Avcıoğlu, 2014).

4. DISCUSSION AND CONCLUSIONS

In this review, some important characteristics of the main plants preferred for turfgrass plantations in the temperate climate zone are discussed. Especially today, when the climatic conditions have changed significantly with a significant decrease in useful water resources, very high and low temperature values, and factors that complicate living conditions such as salinity increasing, it is very important that grass areas, which are an indispensable element of residential areas, continue to exist. It can be said that Cynodon, Zoysia and Paspalum genera and species, which are highly resistant to adverse conditions for the sustainability of parks, gardens and sports fields, where people can spend a peaceful and happy time, will give successful results in the grass field facility.

Conflict of Interest
The authors have no conflicts of interest to declare.

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