



## Comparative performance of warm season turfgrass varieties under Delhi conditions

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### ABSTRACT

The present investigation was carried out at Division of Floriculture and Landscaping, Indian Agricultural Research Institute, Pusa, New Delhi. The experiment was laid out in randomized block design (RBD) with three replications and seven treatments consisting of six varieties (viz. Selection 1, Bargusto, Panama, Panam, Palma and Tifdwarf 419) and *Paspalum notatum* species. These were evaluated for their suitability to be used as turfgrass under Delhi conditions. The suitability was evaluated on the basis of different morphological, physiological and biochemical traits. Out of evaluated varieties and species, Tifdwarf 419 exhibited better performance with respect to shoot dry weight (2.03 g/100 cm<sup>2</sup>), shoot fresh weight (5.78 g/100 cm<sup>2</sup>), root length (17.17 cm), root density (35.00 number/100 cm<sup>3</sup>), relative water content (86.96 %), chlorophyll a (2.63 mg/g fresh weight), chlorophyll b (0.53 mg/g fresh weight) and total chlorophyll (3.24 mg/g fresh weight) when compared to other varieties. Apart from these characteristics, short shoot length of 6.07 cm and high shoot density (331.27 number/100 cm<sup>2</sup> area), along with good colour throughout the growing season was observed in Tifdwarf 419. Selection 1 also showed desirable shoot fresh weight (5.07 g/100 cm<sup>2</sup>), root length (16.10 cm), root density (28.87 number/100 cm<sup>3</sup>) and shoot density (395.40 number/100 cm<sup>2</sup> area). The *Cynodon dactylon* varieties Tifdwarf 419 and Selection 1 were found to be most suitable to be used as turfgrasses in Delhi conditions.

**Key words:** Biochemical and physiological traits, *Cynodon dactylon*, Morphological, *Paspalum notatum*, Warm season turfgrass

Turfgrasses are the plants which form a continuous ground cover that persist under regular mowing and traffic (Turgeon 1980). The warm season grasses are the plants that grow at optimum temperatures of 26.60°C to 35.00°C and their growth decreases during autumn and enter dormancy when soil temperature falls below 10°C (Christians 2004, Turgeon 1980). *Cynodon dactylon* species are one of the most widely used warm season turfgrasses on lawns, roadsides, parks, school grounds, athletic fields, golf courses where dense turf is desired while *Paspalum notatum* grass is useful for lawns as well as roadsides and for slope stabilization as a low maintenance grass (Christians 2004). *Cynodon dactylon* grass is adapted to tropical and warm climate and has good density, texture and wear tolerance making it suitable for high quality turf (Romani 2004, Rodriguez-Fuentes 2009). *Cynodon dactylon* grass also

shows drought and heat tolerance and has the capacity to provide high quality turf with minimal cost and low water inputs (Macolino 2012).

Acceptable turf quality is defined as meeting the appearance expectations for a particular area and includes traits such as green colour, fine leaf texture, high tiller density, and overall aesthetic appeal (Hanks 2005). Delhi is the heart of India and is a home to 16.75 million people (Census 2011). There are many stadiums, parks, hotels, office complex, shopping malls in Delhi where turfgrasses are indispensable part of city life as they contribute to the aesthetic beauty and environmental benefit of the areas, and provide platform for sports, recreation, and host of other activities. The information on turfgrass species is meagre in India, therefore the present study was conducted to find out suitable turfgrasses that will grow under Delhi conditions. The varieties of Bermudagrass and Bahiagrass were evaluated for various morphological, physiological and biochemical traits with the aim of selecting promising varieties.

### MATERIALS AND METHODS

Warm season turfgrass, *Cynodon dactylon* and one species of *Paspalum notatum* (five varieties of Bermuda

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grass, viz Selection 1, Bargusto, Panama, Panam, Palma, and Tifdwarf 419) were used for evaluation. The experiment was laid out in randomized block design, with three replication during 2013-14. These varieties and species were collected through National Bureau of Plant Genetic Resources, New Delhi. Grass stolons were dibbled on raised beds of 2 × 2 m<sup>2</sup> beds during the month of August, 2013. Basal dose of DAP: MOP (2:1) @ 50g/m<sup>2</sup> was applied at the time of planting. The first mowing was done in October 2013 and thereafter, mowing was continued once every month. Data were recorded at monthly intervals for various morphological, physiological and biochemical traits.

The study was carried out at the research farm of the Division of Floriculture and Landscaping, Indian Agricultural Research Institute (IARI), New Delhi during 2013-14. IARI is located at 28°38'23'' N latitude and 77°09'27'' E longitude at an altitude of 228.61 MSL (Agromet, Division of Agricultural Physics, IARI, New Delhi). The area is semi arid with continental climate characterized by hot summers and cold winters. The average annual mean maximum and minimum temperature range was 41.70 °C in June 2014 and 6.80°C in January 2014. Total rainfall recorded during the period of study was 1840.9 mm.

The morphological traits included shoot length (cm), shoot fresh (g) and dry weight (g), root length (cm) and root density per 100 cm<sup>3</sup> volume of soil, length of internode (cm) and shoot density per 100<sup>2</sup> cm area. The shoot length was measured from the base to the tip of randomly selected shoots. The shoot fresh weight and dry weight were taken from 100 cm<sup>2</sup> area in morning hours and dried in hot air oven at 60°C for 72 hr and dry weight recorded. The root length and density were measured by taking out soil core samples up to a depth of 20cm depth. The number of shoots present in 100 cm<sup>2</sup> area was counted for shoot density.

Relative growth rate (RGR) was calculated (Grime and Hunt 1975), from an area of 100 cm<sup>2</sup> by taking the dry weight of the plant at two time intervals, first dry weight (W<sub>1</sub>) after 15 days of mowing (T<sub>1</sub>) and second dry weight (W<sub>2</sub>) after one week (T<sub>2</sub>) of W<sub>1</sub>. RGR was calculated using the formula

$$RGR (g/g/week) = \frac{\text{Log}_{10} W_2 - \text{Log}_{10} W_1}{T_2 - T_1}$$

Membrane stability index (MSI) was measured in leaves by a method described by Sairam *et al.* (2002) and expressed in percentage. The electrical conductivity was measured using 'Century water and soil analyser kit CMK 731'.

Relative water content (RWC) was estimated using formula given by Barr (1968) and expressed in percentage.

Chlorophyll a and b and total chlorophyll were measured by DMSO {Dimethyl sulfoxide, (CH<sub>3</sub>)<sub>2</sub> SO<sub>4</sub>} method and calculated using the following formula

$$\text{mg chl a/g f.wt} = \frac{(12.7 \times A_{663\text{nm}}) - (2.69 \times A_{645\text{nm}})}{\text{fresh weight} \times 1000} \times V$$

$$\text{mg chl b/g f.wt} = \frac{(22.9 \times A_{645\text{nm}}) - (4.68 \times A_{663\text{nm}})}{\text{fresh weight} \times 1000} \times V$$

$$\text{mg total chl/g f.wt} = \frac{(20.2 \times A_{645\text{nm}}) + (8.02 \times A_{663\text{nm}})}{\text{fresh weight} \times 1000} \times V$$

where A is absorbance, V is the final volume in ml and f.wt is fresh weight of tissue in grams.

The data recorded on various morphological, physiological and biochemical traits were analysed using microsoft office excel worksheet and OPSTAT software.

### RESULTS AND DISCUSSION

Variations were observed among the varieties and even within the varieties during the different months for all the traits. Reports have been documented about the interaction of warm season turfgrasses with seasonal variations which affect the quality of the turfgrass (Turgeon 1980). Significant variations were observed in MSI, chlorophyll a, chlorophyll b and total chlorophyll, however there was no significant variations for other traits like shoot length, shoot dry weight, shoot fresh weight, root length, root density, length of internode, shoot density, RGR and RWC of warm season turfgrasses (Table 1). It was also observed that the values for most of the traits like shoot fresh weight, shoot dry weight, chlorophyll a, b, total chlorophyll, relative growth rate, shoot density, root length, internodal length, root density were generally higher during the summer months compared to the winter months (Table 3, Fig 1).

Table 1 Analysis of variance (ANOVA) for different morphological, physiological and biochemical parameters of turfgrass

Source of variation	df	Mean sum of squares												
		Shoot length (cm)	Shoot dry wt (g)	Shoot f. wt (g)	Root length (cm)	Root density (no/100 cm <sup>3</sup> of soil)	Length of internode (cm)	Shoot density (no/100 cm <sup>2</sup> )	RGR (g/g/day)	MSI (%)	RWC (%)	Chl a (mg/f. wt)	Chl b (mg/f. wt)	Tot Chl (mg/f. wt)
Replication	2	0.58	0.02	0.61	1.97	5.50	0.02	104.77	0.00	21.60	1.41	0.74	0.02	2.95
Varieties (V)	6	101.13	0.72	9.53	122.69	1175.11	1.74	293617.81	0.01	24.35*	162.55	3.03	0.18	4.90
Months(M)	4	74.04	3.78	5.20	80.26	213.63	1.30	46281.70	0.01	243.02	303.26	8.48	1.15	16.48
V × M	24	4.90	0.26	0.97	9.13	55.97	0.16	6147.61	0.00	27.41	25.31	0.44*	0.03*	0.65*
Error	68	0.31	0.05	0.05	0.34	5.07	0.01	34.35	0.00	3.80	2.15	0.14	0.01	0.22

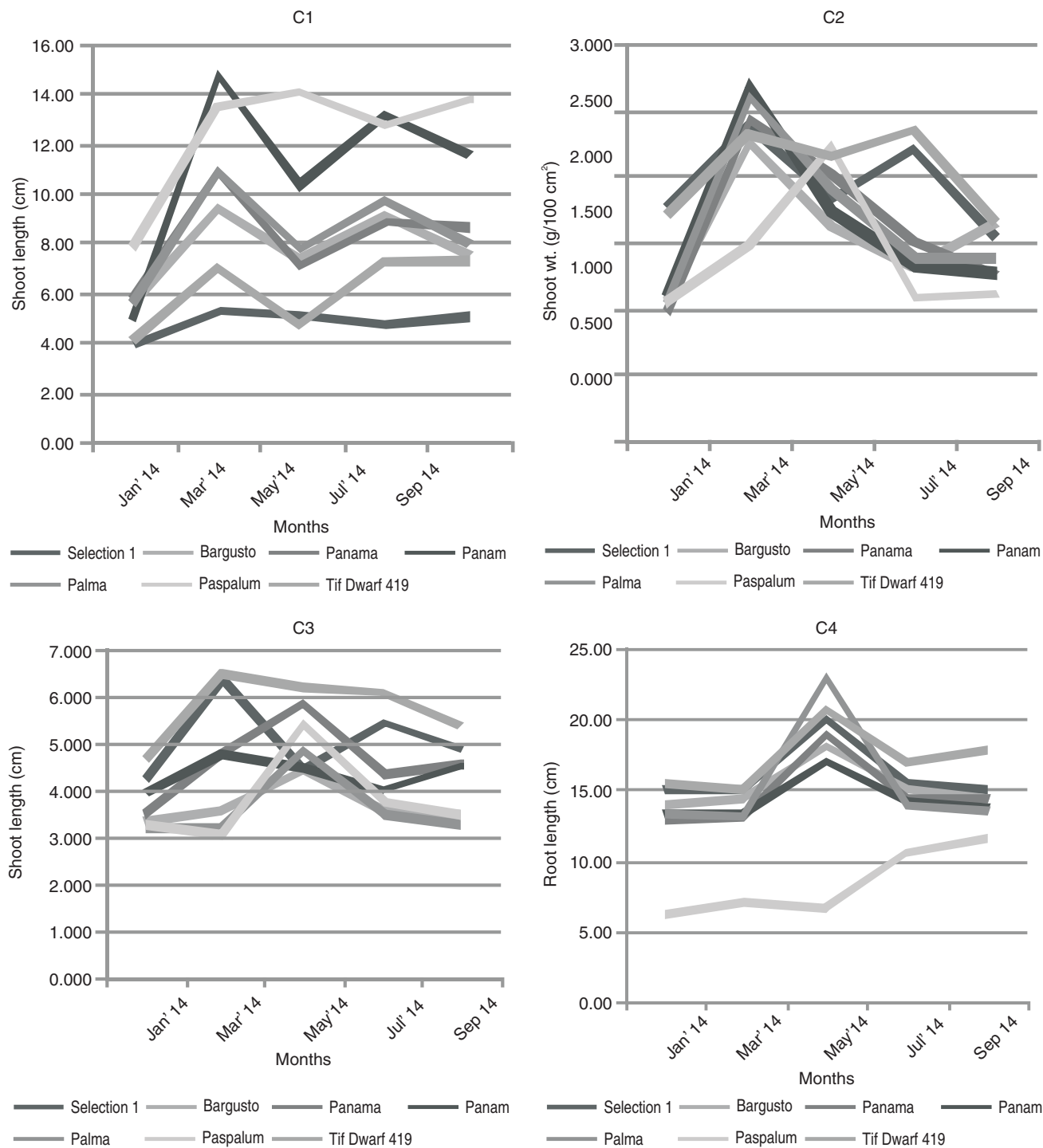


Fig 1 (C1-C4): Interaction between turfgrass varieties and months for shoot length (C1), shoot dry weight (C2), shoot fresh weight (C3), root length (C4)

**Morphological trait**

The maximum shoot length was recorded during March 2014 (10.21 cm), whereas the lowest shoot length in January 2014 (5.30 cm) (Table 3). Shoot length was consistent during summer (Fig 1 C1). Maximum shoot length of 12.27 cm was recorded in *Paspalum notatum* followed by *Cynodon dactylon* var Panam (10.95 cm) while the lowest shoot length was recorded in Selection 1 (4.78 cm) followed by

Tifdwarf 419 (6.07 cm) (Table 2). Similar reports were found on shoot length (i.e 2.10 cm to 3.50 cm) by Pessarakli and Kopec (2008) in Tifway 419 variety of *Cynodon dactylon*. Esmaili and Salehi (2012) also reported shoot length in the range of 7.00 cm to 11.00 cm for *Cynodon dactylon* while Marchion (2004) reported shoot length in the range of 1.30 cm to 11.20 cm in different *Cynodon dactylon* cultivars. Brown and Gorres (2011) reported shoot

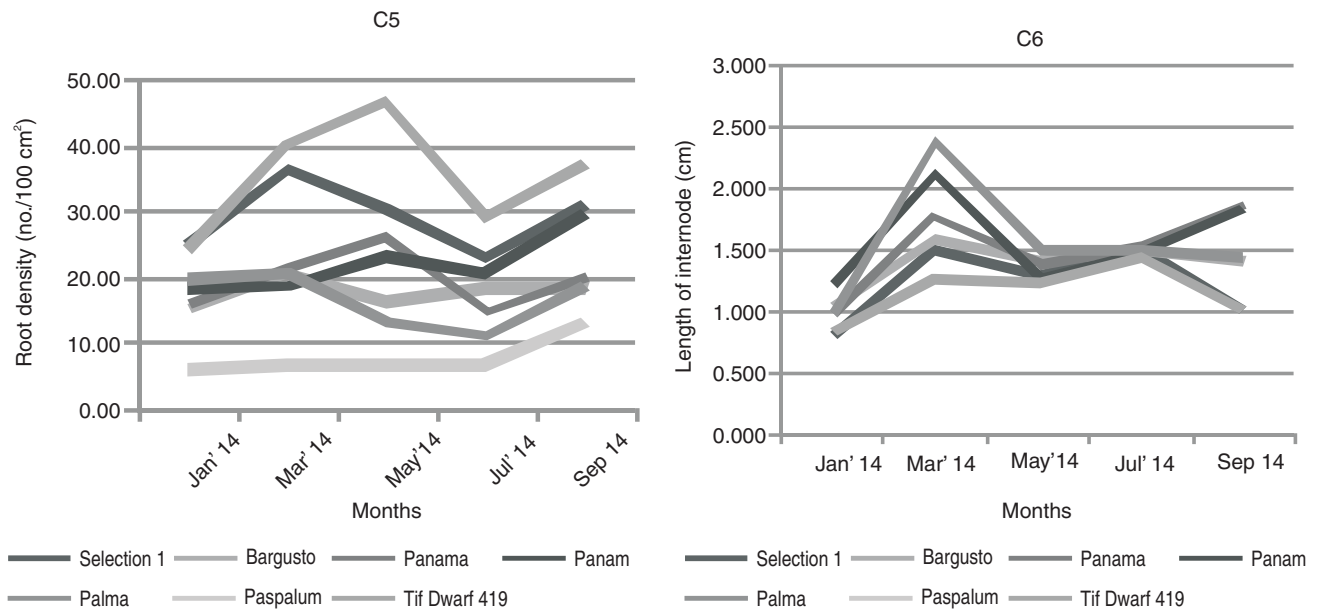


Fig 1 (C5-C6): Root density (C5) and length of internode (C6).

length of 1.30 to 9.00 cm for various cool season grasses.

Highest shoot dry weight was recorded during spring season (March 2014) which was 2.31g while the lowest value was recorded during winter (January 2014), i.e. 1.24 g (Table 3). Tifdwarf 419 showed maximum shoot dry weight of 2.03 g followed by Selection 1 (1.94 g) while *Paspalum notatum* showed minimum shoot dry weight of 1.38 g (Table 2) which is similar to the reports of Murdoc *et al.* (2007). Maximum shoot fresh weight was attained during May 2014 (summer) which was 5.11 g and during winter (January 2014), the fresh weight of grass shoots were lower (3.75 g) (Table 3). Among the different varieties, maximum shoot fresh weight was recorded in Tifdwarf 419 (5.78 g) closely followed by Selection 1 (5.07 g). Palma (3.62 g), Bargusto (3.70 g) and *Paspalum notatum* (3.82 g) showed lower fresh weight than other varieties (Table 2). The values of both the shoot fresh weight and the shoot dry weight remained consistent during the growing periods (i.e. spring and summer months) but decreased during winter (Fig 1C2, C3). These results were in accordance with the results of Macolini (2004) and Esmaili *et al.* (2012).

Longest root was recorded in the month of May 2014 (17.74cm), followed by July 2014 (14.41 cm) and September 2014 (14.38 cm), whereas lowest root length was recorded in January 2014 (12.9 cm) (Table 3). Among the different varieties and species, the longest root was observed to be that of Tifdwarf 419 (17.17 cm) trailed by Selection 1 (16.10 cm) and Palma (15.43 cm) (Table 2). Earlier studies on *Cynodon dactylon* also exhibited root lengths ranging from 17.70 cm to 19.80 cm (Pessarakli and Kopeck 2008) and 18.00 cm to 25.00 cm (Esmaili and Salehi 2012). Sun *et al.* (2013) reported root length in the range of 6.00 cm to 18.00 cm in tall fescue (*Festuca arundinacea*). Root density was calculated as number of roots per 100 cm<sup>3</sup> volume of soil. The highest density was found in Tifdwarf 419 variety

(35.00/100 cm<sup>3</sup> of soil) followed by Selection 1 (28.87/100 cm<sup>3</sup>) and Panam (22.00/100 cm<sup>3</sup>) while the density of *Paspalum notatum* was found to be the lowest (7.87/100 cm<sup>3</sup>) (Table 2). The root density did not vary significantly during the different months. Macolino and Zilioto (2012) reported root length density between 6.00 to 10.00 cm/ cm<sup>3</sup> for different varieties of *Cynodon dactylon*.

The internodal length between two nodes varied between 0.61 cm in *Paspalum notatum* (shortest internode) to 1.58 cm in Panam (longest internode) (Table 2). The varieties in decreasing order in the length of internode are Panam (1.58 cm), Palma (1.56 cm), Panama (1.51 cm), Bargusto (1.40 cm), Selection 1 (1.22 cm), Tifdwarf 419 (1.15 cm) and *Paspalum notatum* (0.61 cm). Lulli *et al.* (2012) also reported longer internodal length in *Cynodon dactylon* varieties compared to *Paspalum notatum*.

The number of shoots per unit area affects the appearance of the turf. Density is desirable as it improves the aesthetic value of the turf. Turf with higher density appears better than turfs with lower densities. In the present investigation, the turf density varied among the two species and among the different varieties of the same species and even within the same variety during the different months which agrees with the report given by Turgeon (1980). Highest density was observed during the month of July 2014 (213.81 shoots/100 cm<sup>2</sup>), whereas the lowest was observed during January 2015 (92.14) (Table 3). Among the varieties, it was observed in Selection 1 (395.40 shoots/100 cm<sup>2</sup>) followed by Tif Dwarf 419 (331.27 shoots/100 cm<sup>2</sup>). *Paspalum notatum* showed sparse density (26.87 shoots/100 cm<sup>2</sup>) while Bargusto (103.00 shoots/100 cm<sup>2</sup>), Palma (102.67 shoots/100 cm<sup>2</sup>), Panam (95.60 shoots/100 cm<sup>2</sup>) and Panama (93.60 shoots/100 cm<sup>2</sup>) showed medium shoot densities (Table 2). Volterrani *et al.* (2008) and Lulli *et al.* (2012) also reported higher density of shoots

Table 2 Mean values of turfgrasses for various parameters

Varieties	Mean values												
	Shoot length (cm)	Shoot dry wt(g)	Shoot f. wt (g)	Root length (cm)	Root density (no/ 83.3 cm <sup>3</sup> of soil)	Length of internode (cm)	Shoot density (no/100 cm <sup>2</sup> )	RGR (g/g/day)	MSI (%)	RWC (%)	Chl a (mg/ f. wt)	Chl b (mg/ f. wt)	Tot Chl (mg/ f.wt)
Selection 1	4.78	1.94	5.07	16.10	28.87	1.22	395.40	0.02	84.55	84.00	2.20	0.42	2.63
Bargusto	7.73	1.57	3.70	15.13	17.33	1.40	103.00	0.05	87.17	84.99	2.53	0.51	3.14
Panama	8.20	1.64	4.58	14.83	19.33	1.51	93.60	0.05	86.25	84.71	2.62	0.51	3.24
Panam	10.95	1.64	4.36	14.41	22.00	1.58	95.60	0.08	87.99	85.50	2.35	0.46	2.92
Palma	8.30	1.67	3.62	15.43	16.33	1.56	102.67	0.05	88.14	83.40	2.50	0.47	3.04
<i>Paspalum notatum</i>	12.27	1.38	3.82	8.33	7.87	0.61	26.87	0.04	85.69	76.75	1.35	0.21	1.63
Tifdwarf 419	6.07	2.03	5.78	17.17	35.00	1.15	331.27	0.04	86.75	86.96	2.63	0.53	3.24
CD at 0.05	0.41	0.17	0.16	0.43	1.65	0.08	4.28	0.00	1.42	1.07	0.27	0.08	0.34
SEm	0.14	0.06	0.06	0.15	0.58	0.03	1.51	0.00	0.50	0.38	0.10	0.03	0.12

in *Cynodon dactylon* than in *Paspalum notatum* as was the case in present experiment. The shoot density varied between 395.40 (shoots/100 cm<sup>2</sup>) and 93.60 shoots/100 cm<sup>2</sup> among the different varieties of *Cynodon dactylon* which was similar to the reports of Leto *et al.* (2008) who recorded highest density of 2.40 shoots/cm<sup>2</sup> and lowest of 1.11 shoots/cm<sup>2</sup> in different *Cynodon dactylon* germplasm. The findings of the present investigation is also similar to that of Esmaili and Salehi (2012) who reported density in the range of 99.00 to 216.00 (number /per 100 cm<sup>2</sup>) in *Cynodon dactylon*.

#### Physiological traits

Relative Growth Rate (RGR) was generally lower during the winter months and higher during the summer months, which is similar to the findings of Alexandrino *et al.* (2005). The maximum RGR was observed during the month of March 2014 (0.08 g/g/day) followed by May 2014 (0.06 g/g/day) and July 2014 (0.05 g/g/day), however, minimum was observed during the month of January 2014, which was only 0.01 g/g/day (Table 3). Variations in RGR among the different varieties, ranged between 0.02 g/g/day to 0.08 g/g/day, with maximum RGR recorded in Panam (0.08g/g/day) variety and the minimum in Selection 1(0.02 g/g/day) (Table 2). Lower values of RGR observed during the experiment, is in agreement with Grime and Hunt (1975), who reported lower RGR in fine leaved grasses. RGR in the present study was calculated taking into consideration only the above ground biomass of the plants, which may have contributed to the lower RGR values. Wide variation among the plant species for RGR have previously been reported by Grime and Hunt (1975), Jarvis Groeneveld (1998) and James and Drenovsky (2007) and many others and it was as high as 386.00 mg/g/day and low as 31.00 mg/g/day. RGR is influenced by various morphological, physiological and biomass allocation characteristics of plants such as ULR (unit leaf rate, i.e g dry mass increase/m<sup>2</sup>/leaf area/day), SLA (Specific Leaf Area), LAR (Leaf Area Ratio), NAR

(Net Assimilation Rate), LWR (Leaf Weight Ratio), photosynthesis, respiration etc. which are affected by environmental conditions in which the crop is grown (Grime and Hunt 1975, James and Drenovsky 2007, Lambers and Poorter 1992, Poorter 2002, Storkey 2004, Alexandrino *et al.* 2005, Han *et al.* 2005), which accounts for the difference in RGR between the two species of turfgrasses and even among their varieties during the different seasons in the present investigation. Among the different factors affecting RGR, SLA is affirmed to be the most important factor by Poorter and Remkes (1990) and James and Drenovsky (2007).

MSI varied significantly between the varieties. The highest MSI was recorded in Palma (88.14%) followed by Panam (87.99%) and Bargusto (87.17%) while the lowest MSI was observed in Selection 1 (84.55%) (Table 2). During the different months, the MSI varied between 84.18% in May 2014 to 92.65% during the month of March 2014 (Table 3).

RWC observed during the experimental period was in range of 80.80% to 89.12% during the different months. RWC never dropped below 80.00% during the entire experimental period; as a result, the turf quality was acceptable throughout the investigation period. Maximum RWC value was observed during the month of March 2014 (89.12%) while the minimum was observed during July 2014 (80.80%) (Table 3). Among the different varieties maximum RWC was observed in Tifdwarf 419 variety (86.96%) followed by Panam (85.50%) and the lowest value was observed in *Paspalum notatum* (76.75%) (Table 2). *Paspalum notatum* comparatively showed lower RWC throughout the different months than the other varieties. The RWC was observed to be above 80.00% throughout the growing season (Table 3), which is at the threshold value for stomatal closure (Duniway and Durbin 1971). The optimum leaf RWC is about 85.00-95.00% (Fu *et al.* 2004, Liu *et al.* 2005) which was found during the month of January 2014

Table 3 Mean values of turfgrasses for various parameters during the different months

Months	Mean values												
	Shoot length (cm)	Shoot dry wt(g)	Shoot f. wt (g)	Root length (cm)	Root density (no/ 83.3 cm <sup>3</sup> of soil)	Length of internode (cm)	Shoot density (no/100 cm <sup>2</sup> )	RGR (g/g/day)	MSI (%)	RWC (%)	Chl a (mg/ f. wt)	Chl b (mg/ f. wt)	Tot Chl (mg/ f.wt)
January 2014	5.30	1.24	3.75	12.91	17.57	0.92	92.14	0.01	85.43	86.44	1.43	0.06	1.53
March 2014	10.21	2.31	4.59	13.01	23.14	1.61	152.29	0.08	92.65	89.12	2.59	0.42	3.43
May 2014	7.99	1.92	5.11	17.74	22.95	1.26	196.10	0.06	84.18	80.87	3.09	0.69	3.78
July 2014	9.36	1.60	4.40	14.41	17.33	1.35	213.81	0.05	85.60	80.80	1.97	0.53	2.43
September 2014	8.79	1.41	4.24	14.38	23.67	1.31	165.95	0.04	85.37	81.57	2.47	0.52	3.00
CD at 0.05	0.34	0.14	0.13	0.36	1.39	0.07	3.61	0.00	1.20	0.91	0.23	0.07	0.29
SEm	0.12	0.05	0.05	0.13	0.49	0.02	1.28	0.00	0.43	0.32	0.08	0.02	0.10

(86.44%) and March 2014 (89.12%). The RWC affects the turf quality, and in *Cynodon dactylon* grass, for acceptable turf quality, the RWC should be above 65.00% (Fu *et al.* 2004). The critical limit of RWC is about 50.00% but it varies between species (Fu *et al.* 2004). The RWC never dropped below the critical level for stomata closure during the entire course of study even during the peak summer months when the temperatures soared to 38.00°C as the soil moisture content was sufficient for the plants, which was similar to the findings of Liu *et al.* (2013) and Macado (2001), who found that plants maintain nearly stable water relationship regardless of temperature when the moisture is ample, but high temperature strongly affects water relations when water is limiting.

#### Biochemical traits

The chlorophyll content of the leaves was generally high during the summers and declined during the winter. Maximum amount for total chlorophyll, chlorophyll a and b was recorded during the month of May 2014 which was 3.78 g/g/f.wt, 3.09 g/g/f.wt and 0.69 g/g/f.wt, respectively whereas the minimum amount was recorded during January 2014 (1.53 g/g/f.wt, 1.43g/g/f.wt, and 0.06 g/g/f.wt, respectively for total chlorophyll, chlorophyll a and b) (Table 3). Among the different varieties Tifdwarf 419 showed highest amount of total chlorophyll (3.24 g/g/f.wt), Chlorophyll a (2.63 g/g/f.wt) and Chlorophyll b (0.53 g/g/f.wt) while the lowest amount was recorded in *Paspalum notatum* [total chlorophyll (1.63 g/g/f.wt), chlorophyll a (1.35 g/g/f.wt) and Chlorophyll b (0.21 g/g/f.wt)] (Table 2). In July 2014, the mean chlorophyll content of varieties was lower than September 2014 due to the lower amount of chlorophyll in the leaves of *Paspalum notatum*. The leaves of *Paspalum notatum* species turned yellow green in colour during summer months. The increase in chlorophyll content

with increasing temperatures during the summer and the subsequent decline in chlorophyll content during winter in *Cynodon dactylon* varieties was observed during the study which is similar to the findings of Esmali and Salehi (2012), Rosental and Camm (1997) and Lewandowska and Jarvis (1977).

Among the different varieties evaluated during the present investigation, Tifdwarf 419 was the best performing variety with respect to shoot dry weight (2.03 g/100cm<sup>2</sup>), shoot fresh weight (5.78 g/100 cm<sup>2</sup>), root length (17.17 cm), root density (35.00 number/100cm<sup>3</sup>), relative water content (86.96 %), chlorophyll a (2.63 mg/g fresh weight), chlorophyll b (0.53 mg/g fresh weight) and total chlorophyll (3.24 mg/g fresh weight) than other varieties. Short shoot length of 6.07 cm and high shoot density of 331.27 (numbers/100 cm<sup>2</sup>), along with good colour throughout the growing season was also observed in Tifdwarf 419. Selection 1 also showed desirable shoot fresh weight (5.07 g/100 cm<sup>2</sup>), root length (16.10 cm), root density (28.87 number/100 cm<sup>3</sup>) and shoot density (395.40 numbers/100 cm<sup>2</sup>). Based on the performances of the different varieties during the present investigation, Tifdwarf 419 and Selection 1 varieties were found to be most suitable to be used as turfgrasses in Delhi conditions.

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