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STOLON PARAMETERS AS INFLUENCED BY DIFFERENT TURF GENOTYPES

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ABSTRACT

The study was conducted during the Rabi season of 2022–24 at the College of Horticulture in Venkataramannagudem, West Godavari District, Andhra Pradesh. The objective was to evaluate the establishment and growth of fourteen turf genotypes under local conditions. The experiment was set up in a randomized block design (RBD) with two replications. The findings showed that *Stenotaphrum secundatum* (G_{11}) had the longest stolon length (67.29 cm). While *Paspalum notatum* (G_7) had the shortest stolon length (12.57 cm), the thickest stolon (7.03 mm) and maximum fresh weight of shoot (6.60 g). On the other hand, *Zoysia matrella* (G_{14}) had the thinnest stolon (0.44 mm) and minimum fresh weight of shoot (1.32 g) at 120 days after planting.

Key words: establishment, growth, turf genotypes, stolon length, fresh weight.

Introduction

Landscape architecture has emerged as a lucrative field in India, with turf grasses serving as a key component. It offers aesthetic enhancement, enriches beauty, and supports ecological harmony. The primary turf species of interest belong to the family *Poaceae*. According to Madison and Green (1994) the benefits of turf grasses can be categorized into three main groups: functional, recreational, and aesthetic components. The thick layer of mowed turf grasses effectively captures water and airborne particles, while also absorbing gaseous pollutants. The proper selection of turf grasses based on climatic conditions, cultural practices, and intended purpose is crucial for ensuring their long-term success and sustainability. Certain traits of turf grass are widely acknowledged as key indicators of quality and are typically assessed through visual estimation (Madison and Andersen, 1963). These visual qualities are inherently based on functional attributes, which are determined exclusively by the vegetative parts of the plant and its growth and developmental characteristics (Gobilik *et al.*, 2013).

Material and Methods

The experimental site was located at College of Horticulture, Dr. Y.S.R Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh. The location falls under Agro climatic Zone-10, Humid, East Coast Plain and Hills (Krishna-Godavari Zone) with an average annual rainfall of 900 mm at an altitude of 18 m (59 feet) above the mean sea level. The experimental site was geographically situated at 16º 63' N latitude and 81º 27' E longitude with hot humid summer and mild winter climate. The experiment was laid out in Randomized block design with two replications. Planting was done by dibbling at a spacing of 10 cm × 10 cm in zig-zag rows in randomized flat beds of size 2 m x 2 m. Hand weeding was done at 40 days interval. Experiment consisted of 14 turf genotypes *viz.*, *Axonopus compressus* (G_1), *Cynodon dactylon* L. 'Panama' (G_2), *Cynodon dactylon* L. 'Selection 1' (G_3), *Cynodon dactylon* L. 'Tif Dwarf 419'(G_4), *Dactyloctenium aegyptium* (G_5), *Eremochloa ophiuroides* (G_6), *Paspalum notatum* (G_7), *Paspalum notatum* 'Argentine' (G_8), *Paspalum notatum* 'Coarse' (G_9), *Paspalum vaginatum* (G_{10}), *Stenotaphrum secundatum* (G_{11}), *Stenotaphrum secundatum* 'Variegatum'(G_{12}), *Zoysia japonica* (G_{13}) and *Zoysia matrella* (G_{14}). All the genotypes were maintained under uniform management practices. Stolon length was measured from base to tip for five randomly selected plants per plot, and the average was calculated. Stolon thickness was measured at the widest point using digital vernier calipers for five stolons per plot at 20, 40, 60, 80, 100, and 120 days after planting, and the average was calculated. Fresh weight of shoot and root was recorded at 120 DAP across fourteen genotypes and averaged. The data on these observations were statistically analysed using randomised block design described by Panse and Sukhatme (1985).

Results and Discussion

Stolon length (cm)

The data on stolon length (cm) as influenced by different turf genotypes is presented in table 1. Significant differences were noticed between different turf genotypes for stolon length at all growth stages (20 to 120 DAP) during the year 2022-23 and 2023-24 as well as in pooled analysis. A gradual increase in stolon length (cm) was observed in all the turf genotypes with passage of time. As per pooled values, the mean of stolon length (cm) showed an increase from 9.79 cm (20 DAP) to 34.71 cm (120 DAP). In pooled data, among different genotypes *Stenotaphrum secundatum* (G_{11}) recorded the highest stolon length (67.29 cm) which was on par with *Stenotaphrum secundatum* 'Variegatum' (G_{12}) (66.63 cm). While, *Paspalum notatum* (G_7) (12.57 cm) recorded the shortest stolon length, which was on par with *Paspalum notatum* 'Coarse' (G_9) (12.68 cm) at 120 DAP.

Paspalum notatum *recorded the shortest stolon lengths*, attributed to its compact growth habit and shorter internodal length (Sangma *et al.*, 2016; Lulli *et al.*, 2012). *Conversely,* Stenotaphrum secundatum showed the longest stolon length (67.29 cm), likely due to greater stolon growth and longer internodal length. Variations in stolon length are influenced by genetic factors, environmental adaptability, and hormonal regulation under stress conditions (Alessandro *et al.*, 2007; Pessarakli & Kopec, 2008; Agnihotri, 2015; Undhad, 2018; Wadekar *et al.*, 2018).

Stolon thickness (mm)

The data on stolon thickness (mm) as influenced by different turf genotypes is presented in table 2. Significant differences were noticed between different turf genotypes for stolon thickness at all growth stages (20 to 120 DAP) during the year 2022-23 and 2023-24 as well as in pooled analysis. Mean stolon thickness as per pooled values, showed an increase from 1.97 mm (20 DAP) to 2.52 mm (120 DAP). In pooled data, among different genotypes, *Paspalum notatum* (G_7) (7.03 mm) recorded the highest stolon thickness which was followed by *Paspalum notatum* 'Coarse' (G_9) (6.68 mm). While, *Zoysia matrella* (G_{14}) recorded the lowest stolon thickness (0.44 mm) which was on par with *Zoysia japonica* (G_{13}) (0.46 mm) at 120 DAP.

The present study revealed variation in stolon thickness among species and cultivars within the same genus. *Zoysia* species exhibited the lowest stolon thickness, closely followed by *Cynodon dactylon* L. 'Tif Dwarf 419,' consistent with the observations of Agnihotri *et al*. (2017). In contrast, *Paspalum notatum* recorded the highest stolon thickness, followed by Argentine Bahia grass, aligning with the findings of Malik *et al*. (2014) and Wadekar *et al*. (2018). The significant differences in stolon thickness among turf genotypes can be attributed to their genetic makeup (Leto *et al*., 2008).

Fresh weight of shoot and root (g)

The data on fresh weight (g) of shoot and root as influenced by different turf genotypes is presented in table 3. Significant differences were noticed between different turf genotypes for fresh weight of shoot and root during the year 2022-23 and 2023-24 as well as in pooled analysis at 120 DAP. The mean fresh weight of shoot and root during the year 2022-23 was 3.44 g and 1.58 g and during the year 2023-24 it was 3.47 g and 1.80 g whereas, the pooled mean of fresh weight of shoot and root was 3.45 g and 1.69 g, respectively.

In pooled analysis, maximum fresh weight of shoot (6.60 g) was recorded by *Paspalum notatum* (G_7) which was followed by *Paspalum notatum* 'Coarse' (G_9) (5.69 g) and minimum fresh weight of shoot was found in *Zoysia matrella* (G_{14}) (1.32 g) which was preceded by *Cynodon dactylon* 'Tif Dwarf 419' (G_4) (1.97 g).

Table 1: Stolon length (cm) in different turf genotypes at different growth stages.

Turf genotypes	Stolon length (cm)								
	20 DAP			40 DAP			60 DAP		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
G_{1}: *Axonopus compressus*	12.56	10.95	**11.76**	15.15	14.47	**14.81**	31.33	33.09	**32.21**
G_{2}: *Cynodon dactylon* L. 'Panama'	12.63	13.05	**12.84**	13.89	14.21	**14.05**	28.31	29.17	**28.74**
G_{3}: *Cynodon dactylon* L. 'Selection 1'	11.39	11.78	**11.59**	12.22	12.10	**12.16**	23.16	23.22	**23.19**
G_{4}: *Cynodon dactylon* L. 'Tif Dwarf 419'	14.57	13.95	**14.26**	15.39	15.21	**15.30**	31.12	29.85	**30.49**
G_{5}: *Dactyloctenium aegyptium*	3.45	4.26	**3.86**	6.39	7.21	**6.80**	8.31	8.58	**8.45**
G_{6}: *Eremochloa ophiuroides*	17.96	19.22	**18.59**	26.15	29.27	**27.71**	38.83	42.12	**40.48**
G_{7}: *Paspalum notatum*	4.12	4.23	**4.18**	4.85	4.79	**4.82**	6.32	6.96	**6.64**
G_{8}: *Paspalum notatum* 'Argentine'	5.23	5.95	**5.59**	6.63	6.71	**6.67**	7.93	7.81	**7.87**
G_{9}: *Paspalum notatum* 'Coarse'	5.12	5.22	**5.17**	6.03	6.19	**6.11**	7.21	7.17	**7.19**
G_{10}: *Paspalum vaginatum*	14.98	15.15	**15.07**	17.35	18.01	**17.68**	37.28	36.82	**37.05**
G_{11}: *Stenotaphrum secundatum*	12.89	15.32	**14.11**	23.15	20.85	**22.00**	30.33	32.10	**31.22**
G_{12}: *Stenotaphrum secundatum* 'Variegatum'	16.83	17.22	**17.03**	25.72	26.19	**25.96**	32.39	35.53	**33.96**
G_{13}: *Zoysia japonica*	1.65	1.55	**1.60**	3.19	3.21	**3.20**	5.58	5.63	**5.61**
G_{14}: *Zoysia matrella*	1.44	1.36	**1.40**	2.45	3.02	**2.74**	5.39	5.21	**5.30**
Mean	**9.63**	**9.94**	***9.79***	**12.75**	**12.96**	***12.86***	**20.96**	**21.66**	***21.31***
SEm ±	0.12	0.18	**0.46**	0.16	0.25	**0.57**	0.27	0.42	**0.67**
CD at 5%	0.36	0.55	**1.39**	0.50	0.77	**1.73**	0.81	1.28	**2.04**

Turf genotypes	Stolon length (cm)								
	80 DAP			100 DAP			120 DAP		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
G_{1}: *Axonopus compressus*	37.36	38.14	**37.75**	47.25	45.72	**46.49**	50.34	51.83	**51.09**
G_{2}: *Cynodon dactylon* L. 'Panama'	29.89	29.63	**29.76**	35.87	35.55	**35.71**	36.18	36.02	**36.10**
G_{3}: *Cynodon dactylon* L. 'Selection 1'	25.32	24.89	**25.11**	30.96	31.15	**31.06**	31.35	33.41	**32.38**
G_{4}: *Cynodon dactylon* L. 'Tif Dwarf 419'	33.10	32.45	**32.78**	38.62	38.44	**38.53**	39.23	39.19	**39.21**
G_{5}: *Dactyloctenium aegyptium*	9.13	9.22	**9.18**	10.42	10.39	**10.41**	12.39	13.26	**12.83**
G_{6}: *Eremochloa ophiuroides*	45.11	40.39	**42.75**	55.39	58.98	**57.19**	56.72	61.42	**59.07**
G_{7}: *Paspalum notatum*	7.10	7.25	**7.18**	9.80	10.30	**10.05**	12.65	12.49	**12.57**
G_{8}: *Paspalum notatum* 'Argentine'	8.14	8.20	**8.17**	10.32	10.46	**10.39**	13.05	13.27	**13.16**
G_{9}: *Paspalum notatum* 'Coarse'	8.11	8.21	**8.16**	9.83	9.71	**9.77**	12.62	12.73	**12.68**
G_{10}: *Paspalum vaginatum*	38.69	38.11	**38.40**	51.72	50.89	**51.31**	51.59	52.11	**51.85**
G_{11}: *Stenotaphrum secundatum*	44.12	43.63	**43.88**	59.72	57.98	**58.85**	68.12	66.45	**67.29**
G_{12}: *Stenotaphrum secundatum* 'Variegatum'	47.09	50.13	**48.61**	58.13	57.98	**58.06**	68.09	65.17	**66.63**
G_{13}: *Zoysia japonica*	7.19	7.35	**7.27**	15.91	16.05	**15.98**	16.33	16.51	**16.42**
G_{14}: *Zoysia matrella*	6.22	6.45	**6.34**	12.39	12.85	**12.62**	14.83	14.61	**14.72**
Mean	**24.76**	**24.58**	***24.67***	**31.88**	**31.89**	***31.89***	**34.54**	**34.89**	***34.71***
SEm ±	0.33	0.49	**0.80**	0.40	0.60	**0.61**	0.43	0.64	**0.87**
CD at 5%	1.00	1.49	**2.44**	1.23	1.83	**1.88**	1.31	1.95	**2.66**

Whereas, maximum fresh weight of root (4.18 g) was recorded by *Paspalum notatum* 'Argentina' (G_8) which was followed by *Paspalum notatum* 'Coarse' (G_9) (2.75 g) and minimum fresh weight of root (0.98 g) was

Table 2: Stolon thickness (mm) in different turf genotypes at different growth stages.

Turf genotypes	Stolon thickness (mm)								
	20 DAP			40 DAP			60 DAP		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
$G_{1:}$ *Axonopus compressus*	1.35	1.38	**1.37**	1.45	1.42	**1.44**	1.47	1.45	**1.46**
$G_{2:}$ *Cynodon dactylon* L. 'Panama'	0.65	0.62	**0.64**	0.68	0.70	**0.69**	0.73	0.75	**0.74**
$G_{3:}$ *Cynodon dactylon* L. 'Selection 1'	0.50	0.51	**0.51**	0.54	0.52	**0.53**	0.56	0.55	**0.56**
$G_{4:}$ *Cynodon dactylon* L. 'Tif Dwarf 419'	0.41	0.39	**0.40**	0.44	0.41	**0.43**	0.45	0.44	**0.45**
$G_{5:}$ *Dactyloctenium aegyptium*	2.09	2.12	**2.11**	2.16	2.18	**2.17**	2.22	2.25	**2.24**
$G_{6:}$ *Eremochloa ophiuroides*	1.35	1.36	**1.36**	1.40	1.39	**1.40**	1.42	1.40	**1.41**
$G_{7:}$ *Paspalum notatum*	5.45	5.47	**5.46**	5.71	5.73	**5.72**	6.61	6.64	**6.63**
$G_{8:}$ *Paspalum notatum* 'Argentine'	4.17	4.20	**4.19**	4.25	4.27	**4.26**	4.35	4.37	**4.36**
$G_{9:}$ *Paspalum notatum* 'Coarse'	5.42	5.48	**5.45**	5.59	5.60	**5.60**	6.21	6.25	**6.23**
$G_{10:}$ *Paspalum vaginatum*	0.66	0.64	**0.65**	0.68	0.66	**0.67**	0.71	0.73	**0.72**
$G_{11:}$ *Stenotaphrum secundatum*	2.43	2.45	**2.44**	2.65	2.68	**2.67**	2.75	2.77	**2.76**
$G_{12:}$ *Stenotaphrum secundatum* 'Variegatum'	2.36	2.38	**2.37**	2.47	2.50	**2.49**	2.61	2.63	**2.62**
$G_{13:}$ *Zoysia japonica*	0.32	0.34	**0.33**	0.36	0.35	**0.36**	0.41	0.42	**0.42**
$G_{14:}$ *Zoysia matrella*	0.33	0.32	**0.33**	0.35	0.34	**0.35**	0.38	0.39	**0.39**
Mean	**1.96**	**1.98**	***1.97***	**2.05**	**2.05**	***2.05***	**2.21**	**2.22**	***2.21***
SEm ±	0.04	0.06	**0.04**	0.04	0.06	**0.04**	0.04	0.06	**0.05**
CD at 5%	0.11	0.17	**0.13**	0.11	0.17	**0.13**	0.13	0.20	**0.16**

Turf genotypes	Stolon thickness (mm)								
	80 DAP			100 DAP			120 DAP		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
$G_{1:}$ *Axonopus compressus*	1.53	1.54	**1.54**	1.68	1.67	**1.68**	1.73	1.71	**1.72**
$G_{2:}$ *Cynodon dactylon* L. 'Panama'	0.78	0.82	**0.80**	0.85	0.87	**0.86**	0.92	0.90	**0.91**
$G_{3:}$ *Cynodon dactylon* L. 'Selection 1'	0.59	0.58	**0.59**	0.62	0.65	**0.64**	0.68	0.65	**0.67**
$G_{4:}$ *Cynodon dactylon* L. 'Tif Dwarf 419'	0.48	0.46	**0.47**	0.51	0.52	**0.52**	0.59	0.55	**0.57**
$G_{5:}$ *Dactyloctenium aegyptium*	2.43	2.45	**2.44**	2.74	2.70	**2.72**	2.76	2.74	**2.75**
$G_{6:}$ *Eremochloa ophiuroides*	1.44	1.45	**1.45**	1.47	1.44	**1.46**	1.50	1.47	**1.49**
$G_{7:}$ *Paspalum notatum*	6.70	6.69	**6.70**	6.73	6.75	**6.74**	7.05	7.00	**7.03**
$G_{8:}$ *Paspalum notatum* 'Argentine'	5.35	5.38	**5.37**	5.85	5.87	**5.86**	5.90	5.92	**5.91**
$G_{9:}$ *Paspalum notatum* 'Coarse'	6.39	6.43	**6.41**	6.62	6.65	**6.64**	6.69	6.67	**6.68**
$G_{10:}$ *Paspalum vaginatum*	0.77	0.75	**0.76**	0.81	0.83	**0.82**	0.87	0.84	**0.86**
$G_{11:}$ *Stenotaphrum secundatum*	2.81	2.78	**2.80**	2.85	2.83	**2.84**	2.90	2.87	**2.89**
$G_{12:}$ *Stenotaphrum secundatum* 'Variegatum'	2.85	2.89	**2.87**	2.95	2.93	**2.94**	2.99	2.96	**2.98**
$G_{13:}$ *Zoysia japonica*	0.42	0.40	**0.41**	0.43	0.41	**0.42**	0.47	0.45	**0.46**
$G_{14:}$ *Zoysia matrella*	0.40	0.41	**0.41**	0.42	0.42	**0.42**	0.44	0.43	**0.44**
Mean	**2.35**	**2.36**	***2.36***	**2.47**	**2.47**	***2.47***	**2.54**	**2.51**	***2.52***
SEm ±	0.25	0.31	**0.28**	0.36	0.41	**0.39**	0.37	0.47	**0.41**
CD at 5%	0.76	0.94	**0.85**	1.09	1.24	**1.18**	1.12	1.43	**1.24**

found in *Cynodon dactylon* 'Tif Dwarf 419' (G_4) which was on preceded by *Zoysia japonica* (G_{13}) (1.11 g).

The highest fresh weight of the shoot could be attributed to greater stolon thickness and larger leaf size

Table 3: Fresh weight (g) of shoot and root in different turf genotypes at 120 DAP.

Turf genotypes	Fresh weight(g) of shoot			Fresh weight(g) of root		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
$G_{1:}$ *Axonopus compressus*	3.24	3.39	**3.32**	1.25	1.27	**1.26**
$G_{2:}$ *Cynodon dactylon* L. 'Panama'	3.27	3.15	**3.21**	1.24	1.30	**1.27**
$G_{3:}$ *Cynodon dactylon* L. 'Selection 1'	2.29	2.45	**2.37**	1.26	1.33	**1.30**
$G_{4:}$ *Cynodon dactylon* L. 'Tif Dwarf 419'	2.00	1.93	**1.97**	1.00	0.95	**0.98**
$G_{5:}$ *Dactyloctenium aegyptium*	2.70	2.88	**2.79**	1.37	1.40	**1.39**
$G_{6:}$ *Eremochloa ophiuroides*	3.35	3.40	**3.38**	1.31	1.35	**1.33**
$G_{7:}$ *Paspalum notatum*	6.56	6.63	**6.60**	2.69	2.57	**2.63**
$G_{8:}$ *Paspalum notatum* 'Argentine'	4.20	4.38	**4.29**	2.71	5.65	**4.18**
$G_{9:}$ *Paspalum notatum* 'Coarse'	5.64	5.73	**5.69**	2.73	2.77	**2.75**
$G_{10:}$ *Paspalum vaginatum*	3.20	3.17	**3.19**	1.20	1.24	**1.22**
$G_{11:}$ *Stenotaphrum secundatum*	3.64	3.51	**3.58**	1.54	1.57	**1.56**
$G_{12:}$ *Stenotaphrum secundatum* 'Variegatum'	3.70	3.81	**3.76**	1.50	1.45	**1.48**
$G_{13:}$ *Zoysia japonica*	3.00	2.83	**2.92**	1.10	1.12	**1.11**
$G_{14:}$ *Zoysia matrella*	1.34	1.29	**1.32**	1.18	1.20	**1.19**
Mean	**3.44**	**3.47**	***3.45***	**1.58**	**1.80**	***1.69***
SEm $\pm$	0.03	0.04	**0.06**	0.13	0.22	**0.18**
CD at 5%	0.08	0.13	**0.19**	0.38	0.67	**0.54**

(both length and breadth), likely resulting from enhanced photosynthetic activity. A similar trend was observed for root fresh weight, possibly due to higher photosynthetic activity supporting greater carbohydrate translocation to the root system, thereby promoting its growth and weight. This variation could also be due to inherent differences in the genetic constitution of the turf grass genotypes. Macolino *et al*. (2012), Ubendra *et al*., (2015) and Sangma *et al*., (2016) also reported similar findings out of their earlier studies on different turf grass genotypes.

Conclusion

From the present investigation it can be concluded that among the turf genotypes, *Stenotaphrum secundatum* exhibited the longest stolon length, while *Paspalum* varieties recorded the shortest stolon length but the highest stolon thickness, and maximum fresh weight of shoot and root. In contrast, *Zoysia* species showed the lowest stolon thickness and the least fresh weight of shoot and root.

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