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Performance of various turfgrass genotype under North Gujarat condition

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Abstract
An experiment was carried out to evaluate different turfgrass genotype for the performance under North Gujarat agro-climatic condition. Wide range of variation among the nine genotypes of turfgrass was recorded with respect to quality characteristics. The results revealed that among various treatments, minimum days taken for 90 per cent establishment, maximum number of runner present per 100 cm^2 area, maximum fresh and dry biomass was recorded in Selection 1 genotype. Maximum number of leaves on runner, maximum length of runner and maximum number of nodes present on runner was recorded in genotype Tifdwarf 419. Shortest leaf length and smallest leaf width was recorded in genotype zoysia grass (Korean grass) and also recorded deepest root in genotype Bermuda grass (Variant TNAU). On the basis of results obtained from the present investigation, it can be concluded that when *Cynodon dactylon* L. genotype Selection 1 was planted by dibbling method at 5 cm × 5 cm distance observed its quick establishment and appropriate growth habit for higher visual appearance.

Keywords: Evaluation, genotypes, turfgrass, turf quality

Introduction
Turfgrasses consist of a remarkably diverse group of species which are selectively used on the basis of application and climatic conditions (Janakiram and Namita 2014) [7]. Cultivated turfgrass is a pervasive feature of the urban landscape in the developed regions of the world. Turf grasses are widely used in enhancing and maintaining the function and beauty of lawns, aesthetic fields, etc. all over the world. Turfgrass provides at least three major benefits to human activities: functional, recreational and ornamental (Wieck 2006 and Turgeon 2011) [19, 15]. Since, wide variability occurs among commercial turfgrasses, the choice of species and/or variety should be taken in high consideration in accordance with the intended use as low maintenance turf, high maintenance sports turf, home lawn or public places, *etc*. Despite, cultural practices are very critical for turf performance, varietal selection adaptable to the particular area plays an important role. The quality of a sports field surface as well as playability is determined by turfgrass species as well as varieties. Turfgrass growth, performance and quality are affected by many environmental factors prevailing locally. Therefore, evaluation for the suitability of turfgrass for a particular region will play a crucial role for their selection. This means, for one season a particular variety can give outstanding result but it may show poor performance in another season or year. No systematic work has been carried out on the aspect of turfgrass evaluation in Gujarat yet, therefore, the present investigation was undertaken to evaluate the different turfgrass genotypes with respect to various bio agronomical and qualitative traits for landscaping and sport's field.

Materials and Methods
The experiment was carried out at College Farm at College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Mehsana district (Gujarat). The experiment was laid out in randomized block design with three replications. Only healthy uniform sprigs of 10-12 cm long stolons were planted at 5 cm × 5 cm spacing in gross plots having 1.5 m × 1.5 m size with net plots of 1.0 m × 1.0 m. Experimental material included five *Cynodon dactylon* genotypes, one *C. dactylon* × *C. transvaalenesis* 'Tifdwarf' hybrid, two different species of

Zoysia, *viz. Z. tenuifolia* and *Z. matrella*, and one other genera Crow foot grass (*Dactyloctenium aegyptium* L.). All the genotypes were maintained under uniform cultural conditions. Observations were recorded during after planting for total days taken for turf grass establishment were calculated from date of planting to fully (100%) establishment of the turfgrass, leaf length (cm), leaf width (mm), number of leaves on runner, length of runner (cm), number of nodes present on runner, number of on runner per 100 cm^2, root depth (cm) fresh and dry biomass (g/100 cm^2). The data were statistically analysed by using Panse and Sukhatme (1985) [10].

Results and Discussion

- **Performance of various turfgrass genotype characters**

The selection 1 (G_1) was significantly earliest to establish and cover the net plot area by 90 per cent in 20.00 days as per data in Table 1. The minimum days taken for turfgrass establishment might be due to better performance and adaptability of *Cynodon dactylon* L. Both the genotype Selection 1 and Tifdwarf established faster under North Gujarat Agro climatic conditions due to their capacity to acclimatize in particular environment and genetic makeup (Dudeck, 1990) [5]. Similar results were also reported by Severmutlu *et al*. (2011) [13], Kevin (2014) [8], Pittaway (2014) [12], Agnihotri *et al*. (2016) [2] and Undhad (2018) [17] in different turf grasses.

Different genotype performed significantly well in leaf length growth. Out of all the different genotype, Zoysia grass (Korean grass) (G_8) recorded shortest leaf length (1.98 cm). Shortest leaf length among the tested genotype might be due to the hereditary characters of genotype, Ubendra *et al*. (2014) [16]. Agnihotri (2015) [1], Undhad (2018) [17] and Wadekar *et al*. (2018) [18] were also reported similar observations in different turf grass species.

The smallest leaf width of 1.61 mm was recorded in Zoysia grass (Korean grass) (G_8). This might be due to variation in leaf width is a genetically controlled parameter (Mallik *et al*. 2014). Similar findings regarding leaf width was reported by Undhad (2018) [17] and Wadekar *et al* (2018) [18] in turf grass.

Significantly the highest number of leaves on runner (29.47) was observed in Tifdwarf 419 (G_2). These might be due to genotypical character of Tifdwarf genotype.

Significantly maximum length of runner (25.45 cm) was observed in Tifdwarf 419 (G_2). *Alessandro et al.* (2007) verified that length of runner may vary from genotype to genotype and also change due to environmental effect with its adaptability to particular region. The performance might be attributed to genetic constitution of varieties apart from various other factors such as hormones production, which was reported to influence the runner growth in turf grass species under stress conditions. Scientist Pessarakli and Kopec (2008) [11], Agnihotri (2015) [1], Undhad (2018) [17] and Wadekar *et al.* (2018) [18] was reported similar observations earlier in various turf grass species.

Data in Table2 showed that maximum number of nodes present on runner (29.48) was recorded in genotype Tifdwarf 419 (G_2). It might be due to individual genotypical character. Number of nodes per runner increased with the reduced the length of internode ultimately it enhanced the node number by shorter internode difference, (Dhanalakshmi *et al*., 2013) [4]. Similar result was also found by Agnihotri *et al.* (2016) [2] and Undhad (2018) [17] in different turfgrass species.

Maximum number of runners present per 100 cm^2 area (17.29) was recorded in genotype Selection 1 (G_1). It might be due to genotype character, also number of runners increased with the reduce the length of internode ultimately it enhanced the node number and from that internode new roots and shoot growth starts which ultimately resulted in maximum number runners (Dhanalakshmi *et al*., 2013) [4]. Similar result was also found by Agnihotri *et al.* (2016) [2] and Undhad (2018) [17] in different turfgrass species.

Bermuda grass (Variant TNAU) (G_6) had produced significantly deepest root (19.30 cm). The root system might be varied with genotype hence genetic variation is the main reason among different grass species or cultivars for wide differences in root depth (Short and Colmer, 1999) [14]. The result was supported by Agnihotri *et al.* (2016) [2], Dhanalakshmi *et al.* (2018) [4] and Undhad (2018) [17].

Table 1: Performance of various turfgrass genotype characters

Various turfgrass genotype	Total days taken for turfgrass establishment	Leaf length (cm)	Leaf width (mm)	Number of leaves on runner	Length of runner (cm)	Number of nodes present on runner	Number of runners per 100 cm^2 area	Root depth (cm)	Fresh biomass (g/100 cm^2)	Dry biomass (g/100 cm^2)
Selection 1 (*Cynodon dactylon* L.) (G_1)	20.00	2.42	1.95	22.34	11.65	15.62	17.29	13.70	37.61	10.69
Tifdwarf 419 (*Cynodon dactylon* L. × *Cynodon transvaalensis*) (G_2)	22.89	2.30	1.71	29.47	25.45	29.48	16.69	11.77	36.37	9.44
Bargusto (*Cynodon dactylon* L.) (G_3)	23.67	5.49	1.79	15.17	12.60	13.21	15.51	17.40	35.55	8.41
Palma (*Cynodon dactylon* L.) (G_4)	26.74	4.64	2.10	22.00	16.16	22.79	10.02	15.57	16.29	6.79
Panama (*Cynodon dactylon* L.) (G_5)	39.81	4.58	2.48	19.04	18.52	23.72	15.25	15.78	30.79	7.37
Bermuda grass (Variant TNAU) (*Cynodon dactylon* L.) (G_6)	29.58	6.66	2.28	21.80	18.47	21.08	12.08	19.30	24.99	6.74
Zoysia grass (Manila grass) (*Zoysia matrella*) (G_7)	74.22	2.23	1.70	13.20	14.57	9.75	11.02	15.89	14.24	1.40
Zoysia grass (Korean grass) (*Zoysia tenuifolia*) (G_8)	81.61	1.98	1.61	12.03	10.68	14.13	12.77	17.03	14.26	1.49
Crow foot grass (*Dactyloctenium aegyptium* L.) (G_9)	51.97	2.98	1.88	9.53	9.45	9.91	10.30	16.96	15.91	2.21
S.Em.±	2.30	0.19	0.12	1.00	0.92	1.42	1.00	0.83	1.64	0.48
C.D. at 5%	6.90	0.57	0.37	2.99	2.77	4.26	3.00	2.50	4.93	1.44
C. V.%	9.68	8.88	11.03	9.45	10.48	13.89	12.92	9.07	11.34	13.77

Table 2: Effect of time of spray, plant growth substances and their interaction on various growth parameters of golden rod

Plant growth substances (P)	Plant height at first harvest (cm)				Total number of suckers per plant at 180 DAT				Spread of plant (N-S)				Spread of plant (E-W)			
	Time of spray (T)															
	t_1	t_2	t_3	Mean	t_1	t_2	t_3	Mean	t_1	t_2	t_3	Mean	t_1	t_2	t_3	Mean
p_1 (GA_3 @ 100 ppm)	129.33	127.33	141.20	132.62	3.46	3.20	3.03	3.23	39.93	35.86	41.66	39.15	42.53	36.20	42.40	40.37
p_2(GA_3 @ 150 ppm)	153.00	133.33	149.20	145.18	5.46	2.96	2.76	3.73	51.53	43.93	41.06	45.51	52.00	43.46	40.93	45.46
p_3 (Triacontanol @ 20 ppm)	143.00	132.00	127.86	134.29	1.86	1.80	1.90	1.85	29.06	28.80	29.46	29.11	30.06	28.53	29.20	29.26
p_4 (Triacontanol @ 30 ppm)	138.80	137.40	132.73	136.31	2.26	1.73	2.23	2.07	32.73	25.93	25.33	28.00	32.06	27.93	25.53	28.51
p_5 (CCC @ 500 ppm)	134.80	133.13	135.80	134.58	2.46	2.13	2.03	2.21	27.26	27.93	33.73	29.64	27.53	29.46	31.60	29.53
p_6 (CCC @ 1000 ppm)	137.27	135.93	134.13	135.78	2.00	2.33	2.53	2.28	28.20	30.26	30.80	29.75	28.06	30.40	29.73	29.40
Mean	139.37	133.19	136.82		2.92	2.36	2.41		34.78	32.12	33.67		35.37	32.66	33.23	
	t	p	t × p		t	p	t × p		t	p	t × p		t	p	t × p	
S.Em±	1.68	2.38	4.12		0.06	0.09	0.15		0.73	1.03	1.79		0.66	0.93	1.62	
C. D. (5%)	4.79	6.77	11.74		0.18	0.26	0.44		2.08	2.95	5.11		1.88	2.66	4.61	
C.V. %	5.23				10.54				9.28				8.32			

Note: t_1: 30 DAT, t_2: 45 DAT, t_3: 30 and 45 DAT

Table 3: Effect of time of spray, plant growth substances and their interaction on various flowering parameters of golden rod

Plant growth substances (P)	Days taken for panicle initiation				Days taken for opening of first floret				Length of panicle (cm)				Diameter of cut flower stalk (mm)			
	Time of spray (T)															
	t_1	t_2	t_3	Mean	t_1	t_2	t_3	Mean	t_1	t_2	t_3	Mean	t_1	t_2	t_3	Mean
p_1 (GA_3 @ 100 ppm)	120.67	134.27	123.00	125.98	121.67	135.00	124.33	127.00	33.00	23.06	22.40	26.15	3.60	3.09	3.20	3.30
p_2(GA_3 @ 150 ppm)	115.27	119.33	129.00	121.20	116.33	122.00	130.33	122.89	35.73	22.86	29.20	29.26	6.06	3.08	4.25	4.46
p_3 (Triacontanol @ 20 ppm)	124.93	129.20	130.73	128.29	125.67	131.33	132.67	129.89	20.60	20.00	18.33	19.64	5.32	3.57	3.07	3.99
p_4 (Triacontanol @ 30 ppm)	131.87	124.33	133.80	130.00	134.33	126.33	135.00	131.89	21.80	23.26	21.13	22.06	4.76	3.38	2.25	3.46
p_5 (CCC @ 500 ppm)	128.47	127.73	133.53	129.91	131.00	128.67	134.67	131.44	18.73	19.40	22.00	20.04	2.07	2.70	2.46	2.41
p_6 (CCC @ 1000 ppm)	116.33	133.33	120.00	123.22	118.00	135.00	122.67	125.22	19.13	22.53	21.20	20.95	2.20	3.10	3.12	2.81
Mean	122.92	128.03	128.34		124.50	129.72	129.94		24.83	21.85	22.37		4.00	3.16	3.06	
	t	p	t × p		t	p	t × p		t	p	t × p		t	p	t × p	
S.Em±	1.62	2.30	3.98		1.56	2.21	3.82		0.54	0.77	1.33		0.16	0.23	0.39	
C. D. (5%)	4.63	6.55	11.34		4.44	6.29	10.89		1.55	2.19	3.80		0.46	0.64	1.11	
C.V. %	5.46				5.17				10.06				19.90			

Note: t_1: 30 DAT, t_2: 45 DAT, t_3: 30 and 45 DAT

Among the different genotype, Selection 1 (G_1) noted maximum fresh biomass (37.61 g/100 cm^2). From this result, it is evident that the highest root shoot growth due to easy and faster establishment, resulting produce more bio mass production and related to better physiological and morphological adaptations as it produced comparatively higher number of stolons or runners which increased clipping yield (Janakiram and Namita, 2014) [7]. Similar result was also found by Agnihotri *et al*. (2016) [2], and Undhad (2018) [17].

The data regarding maximum dry biomass (10.69 g/100 cm^2) was obtained in genotype Selection 1 (G_1). Maximum dry biomass of genotype Selection 1 is due to genotypical characters and genetic as it forms vigorous growth, meanwhile Tifdwarf is also found much predominant due to its runner growth and thick carpet forming ability, Agnihotri *et al*. (2016) [2]. Also reported similar findings earlier with different turf grass species of Undhad (2018) [17] which are in confirmation with the present results.

Summary and Conclusion

On the basis of results obtained from the present investigation, it can be concluded that when *Cynodon dactylon* L. genotype Selection 1 was planted with dibbling method at 5 cm × 5 cm observed its quick establishment and appropriate growth habit for higher visual appearance.

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