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Evaluation of Bermuda turfgrass for various qualitative traits through seed propagation (Bermuda hybrid pro)

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Abstract
Landscaping creates a unique opportunity for establishment of lawn under urban landscape architecture. It provides sustainable development of green plants and natural landforms in crisis of space. Turfgrass is an inevitable part of urban agriculture. Turf also help to reduce noise levels by absorbing and deflecting sounds. Among different turf grasses, Bermuda grass occupies a prime position since it is a warm season perennial species with broad spectrum of adaptation from tropical to subtropical climates. It can be established by sodding, hydro mulching, sprigging, plugging, and stolonizing and seeding. Seeded Bermuda grass cultivars are widely used for their better quality. This study was carried out in Botanical Garden, Department of Floriculture and Landscaping, Coimbatore to evaluate the performance of Bermuda hybrid pro through seed propagation. The experiment design was a Randomized Block Design with nine treatments with different N (5, 10, 20, 30 m^2 N) and K (4,5,8,10 m^2 K) applications. All the treatments were replicated thrice. Qualitative data was observed at 15 DAS, 30 DAS, 45 DAS. Results indicated that maximum plant height (14.92), shoot length (15.47), root length (7.28), leaf length (13.42), leaf width (0.48), internodal length (2.92) was observed at higher nutrient concentration (T_8-30g/m^2 N + 30g/m^2 P + 10g/m^2 K+ Vermicompost (250g).

Keywords: DAS- days after sowing, randomized block design, seeds, Bermuda hybrid pro

Introduction
Turf grasses are a remarkable diverse group of species that are used selectively based on applications and/or climatic conditions (Janakiram and Namita 2014). Among the most important plant elements it is widely used in the landscape to improve aesthetic value and microclimate. It is a hybrid derivative that is widely used for sports fields, lawns, parks, golf courses, and general utility turf all over the world. Bermuda grass grows best in high sunlight and temperatures, mild winters, and has a high recovery rate, making it a popular grass for golf and sports fields (Taliaferro *et al.*, 2004 and Hanna *et al.*, 2013) [15, 8]. Beard (1973) stated that bermuda grass grows well in loamy sand, coarse sandy loam, and loam soil textures. Bermuda grass cultivars are most susceptible morphological and biochemical responses to water deficit conditions (Riaz *et al.*, 2010) [13]. One of the most widely used species is Bermuda grass, *Cynodon dactylon* (L.) pers., which is drought and salt resistant (Etemadi *et al.*, 2005) [7]. Drought resistance mechanisms include drought avoidance, tolerance, and escape (Levitt, 1972) [12]. Bermuda grass and Seashore paspalum are good examples of turf grasses with good drought avoidance mechanisms, according to Harivandi *et al.*, 2009. There are two types of turf propagation either by seeds or vegetative means. Vegetative propagation methods includes sod, plugging, sprigging, and stolons. Propagation through seeds promotes extensive root growth. It also makes the turf more resistant to drought and able to access optimum nutrients in the soil. Over seeding can make the lawn thick, lush. Nutrient applications are critical for hybrid bermuda grasses. Turf grass nutrient management is critical because mineral nutrition has a significant impact on turf grass performance and physiology. N is the most important macronutrient among N, P, and K. Hence, the objective of the study was to investigate the performance of Bermuda hybrid pro propagation through seeds under different N and K levels.

Materials and Methods
The present research was conducted at Botanical Garden, Department of Floriculture and Landscaping, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India. Which is geographically situated at an altitude of

426.72 meters above mean sea level (MSL) and between 11°02" North latitude and 76°57' East longitude. The material utilized for the present study is Bermuda hybrid seeds. At the optimum moisture content of the soil, the field was ploughed twice with a tractor and a cultivator. Clods were broken with the assistance of a cultivator. The field was cleared from weeds, stubbles, and roots after that the land was fine-tilthed. Watering was done on a regular basis to allow the weed seeds in the research site to germinate, and germinated weeds were removed at regular intervals. Further, the soil was drenched with chlorpyriphos to prevent from termite attack. The experiment was laid out in a Randomized Block Design (RBD) with nine treatments (including 5 N levels and 4 K levels) and three replications. The experimental plots of size 2x1 m^2 sunken bed was prepared. The sunken bed were uniformally filled with red sand and river soil in the ratio of 1:1. The observations *viz.*, shoot length, root length were recorded at 15^{th},30^{th} and 45^{th} days after sowing. Physiological parameters *viz.*, total chlorophyll (Yoshida, *et al.*, 1971), proline (Bates *et al.*, 1973), relative water content (Weatherly, 1950) were analyzed. The mean performance of turf grass species for morphological traits was calculated by Microsoft office excel worksheet, 2007 version. The analysis of variance for each variable was done as per the procedure described by Panse and Sukhatme (1985). The mean and standard error (SE), critical difference (CD) were worked out as per standard methods (Panse and Sukhatme 1967).

Treatment details

T_1	5g/m^2 N + 30g/m^2 P + 6g/m^2 K+ Vermicompost(250g)
T_2	10g/m^2 N + 30g/m^2 P + 6g/m2 K+ Vermicompost(250g)
T_3	15g/m^2 N + 30g/m^2 P + 6g/m2 K+ Vermicompost(250g)
T_4	20g/m^2 N + 30g/m^2 P + 6g/m2 K+ Vermicompost(250g)
T_5	30g/m^2 N + 30g/m^2 P + 4g/m^2 K+ Vermicompost(250g)
T_6	30g/m^2 N + 30g/m^2 P + 5g/m^2 K+ Vermicompost(250g)
T_7	30g/m^2 N + 30g/m^2 P + 8g/m^2 K+ Vermicompost(250g)
T_8	30g/m^2 N + 30g/m^2 P + 10g/m^2 K+ Vermicompost(250g)
T_9	Control (Vermicompost- 250g/m^2)

Results and Discussion

Statistical analysis revealed highly significant differences for the various growth related traits for species under study. Various turf grass species have their own peculiar foliage colour and that would be the most desired trait for landscaping perspective. The various qualitative traits of turf grass are discusses below. All the morphological parameters differs depending on the nutrient application on Bermuda turfgrass. The time taken for germination are given in tabe 2. Seeds showed better germination through hybrid seeds.

Morphological parameters

It could be related to a various factors that influence shoot growth rate, one of which is ethylene production, which has been shown to influence shoot growth in turf grasses under stress conditions (Verslues *et al.*, 1998). The highest shoot length was observed in T_8 (15.47cm) and the least in T_9 (11.32). One of the most important survival factors for turf grass growing under water-stressed conditions is root length (Simanton and Jordan, 1986). The root growth and development of various turf grasses showed wide variations (Beard, 1973). Bermuda developed a fairly deep root system among the warm season grasses compared to Zoysia and St. Augustine which developed moderately deep and medium root systems, respectively (Beard, 1973).

Root length is thought to be an important survival factor for turfgrass growing in water-stressed areas (Simanton and Jordon, 1986). Turf grasses with longer root lengths require less water and are more drought tolerant. In drought avoidance selection, rooting depth is more important than total root production (Erusha, 1986, Sullivan, 1983) [6, 14]. Carrow and Petrovic (1992) [3] reported that under compacted soil conditions, grass roots accumulate at the surface instead of growing deeper into the profile. Grasses with deep root systems can sustain for longer periods of drought than grasses with shallow root system (Watschke and Schmidt, 1992). The highest root length observed in T_8 (7.28) and least in T_9 (4.78).Observations pertaining to the length of individual leaf blade (cm) are presented in table 3. On 45^{th} day T_8 (13.42cm) had significant leaf length and least is T_9 (11.59cm). The highest morphological parameters was observed in T_8 (30g/m^2N+30g/m^2P+10g/m^2K+ Vermicompost (250g)) may be due to application of high NPK. Nitrogen (N) promotes growth, density, and colour in Bermuda grass and is frequently the most imitating nutrient for turf grass growth and development. Likewise potassium (K) is important for turfgrass quality, root growth, disease resistance, and cold hardiness (Snyder and Cisar, 2000).

Table 1: Qualitative traits of Bermuda Hybrid Pro

Seedling rate g/m^2	35
Overseeding rate on Bermuda grass g/m^2	150-200
Seeds per gram	570
Colour	Dark green
Leaf texture	Very fine
Growth habit	Spreading
Heat tolerance	Excellent
Salt tolerance	Maximum

Table 2: Days taken for Bermuda to germinate/ days taken for 50% germination

Treatment No.	Days taken for germination	Days taken for 50% germination
T_1	3.92	8.82
T_2	4.28	8.99
T_3	4.57	9.18
T_4	4.82	9.52
T_5	5.07	9.75
T_6	5.27	9.91
T_7	5.51	10.36
T_8	5.62	10.42
T_9	3.45	8.69
Mean	4.72	9.51
SEd	0.0686	0.2346
CD 5%	0.1454	0.4973

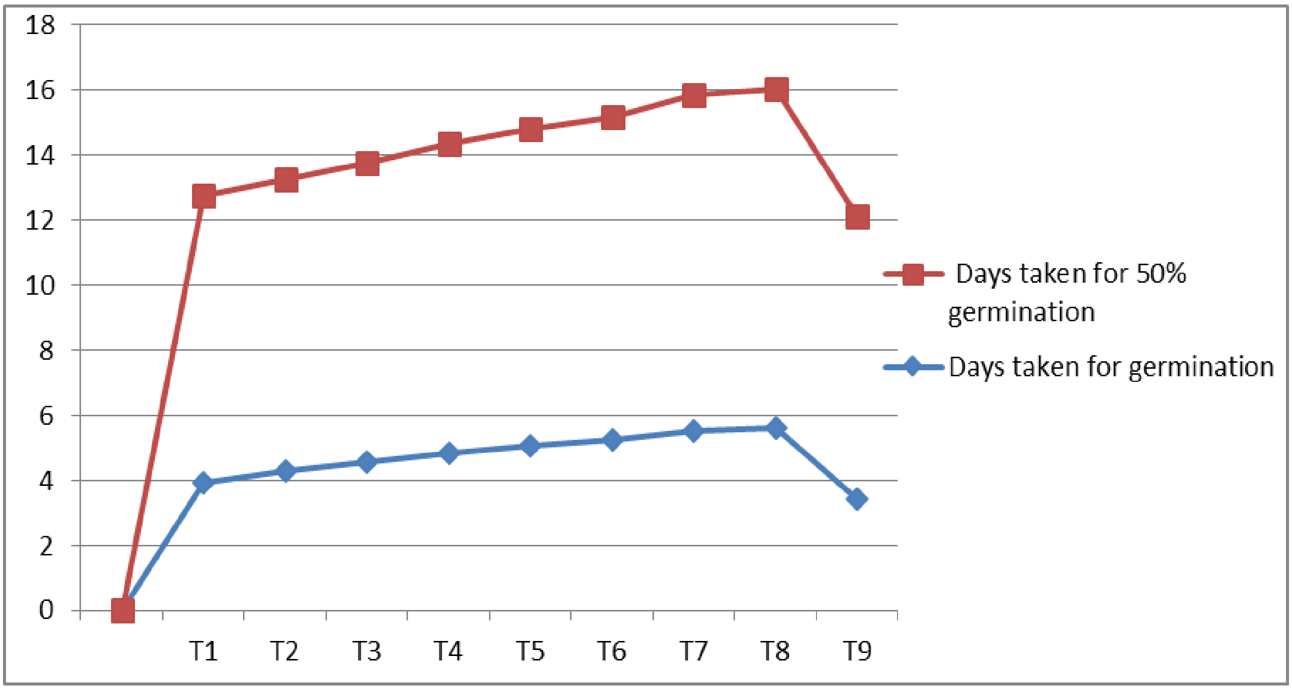

Fig 1: Days taken for germination/ Days taken for 50% germination

Table 3: Mean performance of bermuda turf grass for morphological traits

Treatment No.	Plant Height (cm)			Root Length (cm)			Shoot Length (cm)		
	15th	30th	45th	15th	30th	45th	15th	30th	45th
T_1	2.98	8.72	10.92	1.42	3.29	4.26	3.92	6.63	10.92
T_2	3.38	9.63	11.85	1.51	3.38	5.329	3.99	7.32	11.46
T_3	3.52	9.82	12.53	1.52	3.41	4.87	4.56	7.57	11.74
T_4	3.64	10.38	12.81	1.55	3.67	6.36	4.74	8.41	12.77
T_5	3.79	10.74	13.64	1.64	3.75	5.76	5.42	8.59	12.86
T_6	4.36	11.81	13.78	1.83	3.48	6.73	5.54	8.89	13.48
T_7	4.51	12.47	14.86	2.08	3.98	6.81	5.71	9.52	14.51
T_8	4.77	12.71	14.92	2.12	4.18	7.28	6.32	9.71	15.47
T_9	2.81	8.64	10.84	1.38	3.21	4.18	3.85	6.51	11.32
Mean	3.75	10.54	12.90	1.67	3.59	5.73	4.89	8.12	12.72
SEd	0.092	0.2199	0.2483	0.0438	0.0883	0.1224	0.089	0.1650	0.2701
CD 5%	0.1912	0.4662	0.5264	0.0929	0.1872	0.3018	0.1901	0.3497	0.5725

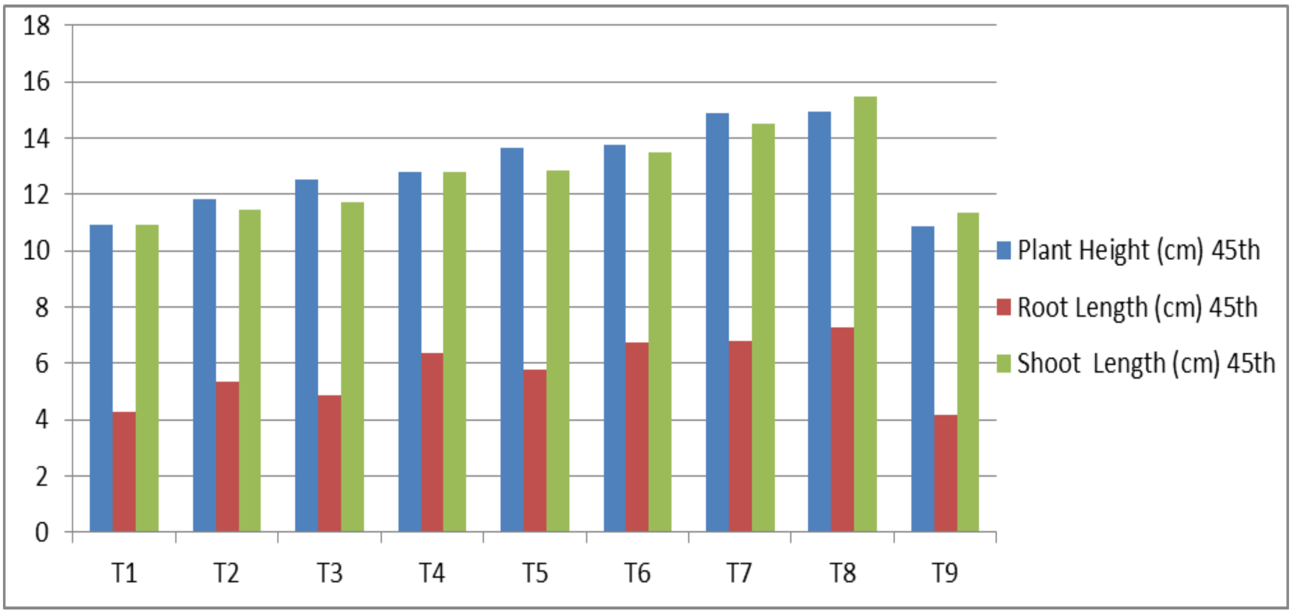

Fig 2: Effect of nutrient treatment on Plant height, Root length, Shoot length

Table 4: Mean performance of Bermuda turf grass for morphological traits

Treatment No.	Leaf Length (cm)			Leaf Width (cm)			Internodal Length (cm)		
	15th	30th	45th	15th	30th	45th	15th	30th	45th
T_1	3.05	6.25	11.75	0.18	0.27	0.38	0.45	0.92	1.97
T_2	3.12	6.36	12.48	0.20	0.30	0.41	0.52	0.98	2.24
T_3	3.25	6.45	11.86	0.21	0.31	0.42	0.61	1.31	2.47
T_4	3.34	6.51	12.60	0.23	0.32	0.44	0.74	1.46	2.58
T_5	3.55	6.72	12.86	0.24	0.33	0.45	0.81	1.57	2.64
T_6	3.78	6.85	12.97	0.25	0.35	0.45	0.96	1.62	2.71
T_7	4.02	7.22	13.21	0.26	0.37	0.46	1.18	1.77	2.84
T_8	4.10	7.38	13.42	0.28	0.39	0.48	1.25	1.82	2.92
T_9	3.14	6.18	11.59	0.17	0.25	0.36	0.34	0.88	1.86
Mean	3.48	6.65	12.52	0.22	0.32	0.42	0.76	1.37	2.47
SEd	0.0574	0.1342	0.2866	0.0045	0.0043	0.0094	0.0215	0.0385	0.0484
CD 5%	0.1218	0.2844	0.5949	0.0096	0.0092	0.0200	0.0455	0.0816	0.1025

Conclusion

Hybrid Bermuda grasses are highly dependent on nutrient applications. Proper nutrient management of turfgrass is a crucial aspect of turf management as mineral nutrition greatly influences the performance and physiology of turfgrass. Bermudagrass provides a high quality turf and is the most extensively used warm season turfgrass on athletic fields, lawn, parks, and urban lanscapes due to its high tolerance (heat and drought) and quick recovery. Turfgrass chlorophyll concentration varied depending on their species and different treatments. From these results it is concluded that T_8 (30g/m^{2}N+30g/m^{2}P+10g/m^{2}K+ Vermicompost (250g)) has the better morphological characters compared with other treatments cause of higher nutrients of N and K.

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