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Evaluation of Lawn Grasses for Turf Quality on Physiological Parameters

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ABSTRACT

The present investigation entitled "Evaluation of lawn grasses for turf quality on physiological parameters was carried out at Modibaug Garden of Horticulture Section, College of Agriculture, Pune. In the experiment, nine lawn grass species viz. Korean grass, Argentine grass, Pensacola grass, American blue grass, Weeping love grass, St. Augustine grass, Bermuda grass, Phosphelone grass and Taiwan grass were evaluated with three replications and was laid out in Randomized Block Design. Among the lawn grasses studied American blue grass and Bermuda grass were recorded highest chlorophyll content. The Pensacola grass showed maximum root to shoot ratio, root fresh weight followed by American blue grass and maximum fresh weight of shoot and dry weight of root was observed in weeping love grass whereas maximum fresh weight of roots was recorded in Argentina grass. Lowest chlorophyll content, root-shoot ratio weight, shoot fresh weight, roots fresh weight, shoot dry weight was recorded in Taiwan grass. American blue grass and Bermuda grass were the quickest lawn grass species to establish however the Taiwan grass was found slowest.

***Key words*:** Chlorophyll, Root weight, Shoot-root ratio, Shoot fresh weight

A lawn is an area where grass is grown and is the basic feature of any garden. Landscape architecture has become a profitable venture in India and turf grasses are considered as an integral part of landscape. In urban areas provides aesthetic value, enhances beauty and improves to ecological balance. In recent time, the rapid urbanization, changing environment, expanding buildings, growing interest to beautify rural and urban areas, emphasis on outdoor living and recreation, prevention of soil erosion, better understanding of aesthetic values has laid emphasis on lawn grass research in our country [1]. Turf grasses are widely used in enhancing and maintaining athletic fields, golf courses, cricket, and other sport areas etc. Proper selection of turf grasses as per environmental conditions, cultural practices and as per purpose as well as utility is very important. Perennial turf grasses offer one of the most cost-efficient methods to control wind and water erosion of soil, which is very important in eliminating dust and mud problems around home, factories, school and other public and business places [2]. The dense plant canopy of mowed turf grasses is effective in entrapment of water and airborne particulate material as well as in absorbing gaseous pollutants. The grasses belong to a larger group of plants called the monocotyledons or monocot [3]. They usually have parallel veins in their leaves, stem with vascular bundles and flower and flower parts in multiples of three. The grasses are easily distinguished from the other families by the two ranked arrangement of their leaves. Each successive leaf of a grass is attached at the 180-degree angle from the previous leaf. The leaves of sedges are three ranked, and the leaves of rushes are round in cross section. The turf grasses are divided into two groups, one is cool season and another is warm season types. As the name indicates, the cool season species are best adapted to the cooler times of year and they thrive in temperature from 65-75°F (18 to 24°C). The cool season grasses include genera viz., *Poa* (blue grass), *Festuca* (Fescues), *Agrostis* (bent grass and *Lolium* (rye grass). The warm season grasses are best adapted to temperature 80 to 95°F (27 to 35°C). The warm season grasses are represented by more genera than cool season grasses [4]. The primary warm season grasses include the Bermuda grass (*Cynodon sp*. Rich), Zoysia grass (*Zoysia* sp. Wild.), St. Augustine grass (*Stenotaphrum secundatum* [Walt] Kuntze), Bahia grass (*Paspalum notatum* Flugge), Centipede grass (*Eremochloa ophiuroides* [Munro.] Hack) and Carpet grass (*Axonopus sp*.). Turf grasses benefits may be divided into three groups that is functional, recreational and aesthetic components [5].

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MATERIALS AND METHODS

The quality planting material was used for the experiment as per the standards. The materials for the study used were nine lawn grasses species viz. Argentine grass, Pensacola grass, Weeping love grass, Korean grass, and

Bermuda grass, American blue grass, Taiwan grass and Phosphelone grass were collected from Konda Laxman Telangana State Horticulture University, College of Horticulture, Rajendranagar, Hyderabad.

Brief description of the fallowing lawn species

Korean grass (Zoysia japonica)

This is most widely used species and commonly known as Korean grass. It has stiff and vertical leaf blades, with rolled venation and has fringe of hairs on leaves and has stolons and shorts rhizomes with husk on nodes are generally uniform in length.

Argentine grass (Argentine bahia)

Argentine grass is the most widely used turf grass. This is a warm season lawn and pasture grass and can survive period of drought. It involves moderate maintenance and moving and is prone to less disease and insect problems when compared to other warm lawn grass type. It is a hardy grass for lawn purpose.

Pensacola grass (Paspalum notatum flugge)

Pensacola is a tropical and subtropical perennial grass. It has a medium texture with thick and woody rhizomes and forms a relatively open turf. Leaves have rolled venation while ligules are membranous with long hairs on the collar regions.

American blue grass (Poa pretensis)

American blue grass is the most widely used cool season turf grass. It has a boat shape leaf tip and folded venation. The lack of a visible ligules and the presence of rhizomes are important characteristics of this grass.

Weeping love grass (Eragrostis curvula (Schrad)

Weeping love grass is a rapidly growing warm-season bunchgrass that was introduced into the U. S. from East Africa. The many long, narrow leaves emerging from a tight tuft are pendulous, with the tips almost touching the ground. The drooping leaf characteristic gives rise to the name “weeping” love grass. Leaf height is rarely above 12 inches (30 cm).

St. Augustine grass (Stenotaphrum secundatum (Walt.)

The collar is one of the special characteristics for identifying St. Augustine grass. The blade usually takes a 90-degree angle from the sheath at the collar. It forms a dense turf; however, it has a very coarse textured leaf. It is susceptible to cold temperature and becomes dormant during winters.

Bermuda grass (Cynodon dactylon)

It is a primary warm season turf grass. It has rhizomes and stolon with a deep, fibrous root system occurs at the nodes of the stolons. It has folded venation; leaf blade is 1.5 to 2 mm wide with fine texture. Bermuda grass is sensitive to cool temperature and ceases its growth, loses its chlorophyll and take on a brown tan colour when soil temperature falls below 10°C (50°F).

Phosphelone grass (Axonopus compressus)

Phosphelone grass are warm season grass is a generally known as carpet grass. It grows well on poor and wet soil where other grasses do not even grow. It is shallow rooted and hence do not tolerate drought condition and ideal for shady, damp and moist area.

Taiwan grass (Arundo formosana)

Taiwan it is a warm season grass. That grows well in hot climate and poor growth in cool climate. Its growing and spreading growth is very slow. Its growth habits are generally underground rhizomatous structure. Leaf size is 1.5-2.5 cm.

Treatment details

Treatments	Common and scientific name of grasses
T_1	Korean grass (*Zoysia japonica*)
T_2	Argentine grass (*Argentine bahia*)
T_3	Pensacola grass (*Paspalum notatum*)
T_4	American blue grass (*Poa pretensis*)
T_5	Weeping love grass (*Eragrostis curvula*)
T_6	St. Augustine grass (*Stenotaphrum secundatum*)
T_7	Bermuda grass (*Cynodon dactylon*)
T_8	Phosphelone grass (*Axonopus compressus*)
T_9	Taiwan grass (*Arundo formosana*)

RESULTS AND DISCUSSION

Chlorophyll content (mg/100mg)

The chlorophyll content of the different species presented in (Table 1). From the data it can be revealed that the chlorophyll content of the lawn grasses differed significantly in different species measured at 30, 60, 90, 120, 150 and 180 days after transplanting. The highest Chlorophyll content (69.59 mg/100mg) observed in Bermuda grass followed by (64.73 mg/100mg) by American blue grass and Phosphelone grass (63.57 mg/100mg). The least Chlorophyll content (37.22 mg/100mg) was recorded by Taiwan grass. The present experimental results are in line with the finding reported by [6] reported that ‘Northwood’ (51.0) and ‘Franksred’ (49.8) and lowest in ‘Redskin’ (40.3) and ‘Autumn Blaze’ (40.1) and Chlorophyll levels on a fresh weight basis (Extractable CHL) ranged from 5.38 $mg.g^{-1}$ for Fairview Flame to 3.94 $mg.g^{-1}$ for October Glory. Similarly, [7] assessed the Chlorophyll in St. Augustine grass. Above result found by [8] found between SPAD readings and nitrogen leaf content varied between 44.3 for *Festuca arundinacea* cv. Lekora and 40.5 for annual ryegrass (*Lolium multiflorum* Lam.) cv. Jiskra. [9-10] examine whether the adverse effects of drought and heat alone or in combination on tall fescue (*Festuca arundinacea* L.) and Kentucky bluegrass (*Poa pratensis* L.). Similar study conducted by [11] reported that the species of *A. compressus, A. affinis, C. dactylon ‘satiri*’, *C. dactylon* ‘tifdwarf’ and *A. compressus* ‘pearl blue’ had high amount of total chlorophyll under control condition whilst *P. vaginatum* maintained high amount of total chlorophyll under salt stress condition. Flurprimidol or Mefluidide plant growth regulators (PGRs) are increased the chlorophyll content to 46 mg cm^{-2} from plants [12].

Fresh and dry weight (g)

The Fresh and dry weight of the different species presented in (Table 1-2). The data regarding observation on fresh and dry weight (g) was recorded during this course of investigation. It is seen from the data that there was significant difference between different species of lawn grasses. The data showed that the maximum fresh weight of shoot (3.50 g) and dry weight of roots (1.16 g) was recorded in Weeping love grass whereas, the maximum fresh weight of roots was recorded in Argentine grass (3.0 g). The present experimental finding is in conformity with the work reported by [13-14] in Creeping Bent grass (cv. Penncross). Similarly, [15] reported in Bermuda grass (*Cynodon* spp.) cultivars ‘celebration’ (0.79 g), ‘Tifsport’ (0.37 g) and ‘Aussie Green’ (0.48 g) respectively. Similar result founded by [16] in *Lolium perene* (0.16 g and 0.04 g), whereas minimum was observed in *Agrostis palustris* (0.04 g and 0.012 g). Shoot dry weight indicates the biomass production under stress conditions. Similar, [17] assessed the Shoot dry matter (DM) weights of both Bermuda grass and seashore paspalum (0.30-0.54 g). Similar results founded by [18] in the genus *Festuca* reported that seedlings of tall fescue cultivars and one of the red fescue cultivars ‘Rahela’ were characterized by the largest dry weight of the above ground part and root dry weight (0.024 g) followed ‘Tarmena’ (0.023 g) and ‘Adio’ (0.021 g). Morphological and Biochemical responses of Bermuda grass cultivars, Khabbal, Dacca, and Fine Dacca had maximum shoot fresh weight (48.3 g, 42.3 g and 19.5 g, respectively) and dry weights (44.9 g, 38.0 g and 20.0 g), while least shoot fresh (43.5g, 29.1 g and 10.6 g) and dry weights (39.5 g, 26.0 g and 9.0 g). [19-20] recorded maximum fresh weight of clips (4.2 g) was noted in the Bermuda grass cultivar ‘Fine Dacca’ followed by the ecotype ‘Khabbal’ (4.1 g) and dry weight of clips (1.5 g) noted in the ecotype and ‘Fine Dacca’.

Table 1 Chlorophyll content (mg/100 gm) and shoot fresh weight (g) of lawn grasses at various growth stages

Treatments	Chlorophyll content (mg/100gm)						Shoot fresh weight (g)					
	30	60	90	120	150	180	30	60	90	120	150	180
T_1	49.44	53.45	54.74	55.79	56.88	57.49	49.44	53.45	54.74	55.79	56.88	57.49
T_2	45.95	48.19	50.53	52.18	52.96	54.20	45.95	48.19	50.53	52.18	52.96	54.20
T_3	40.89	44.16	46.48	48.26	49.04	50.07	40.89	44.16	46.48	48.26	49.04	50.07
T_4	59.61	61.44	62.43	63.27	64.05	64.73	59.61	61.44	62.43	63.27	64.05	64.73
T_5	36.36	39.93	41.32	42.58	43.29	44.71	36.36	39.93	41.32	42.58	43.29	44.71
T_6	52.89	55.29	57.83	59.36	59.89	60.77	52.89	55.29	57.83	59.36	59.89	60.77
T_7	60.32	63.03	66.09	67.78	68.62	69.59	60.32	63.03	66.09	67.78	68.62	69.59
T_8	55.74	57.66	60.24	61.21	62.31	63.57	55.74	57.66	60.24	61.21	62.31	63.57
T_9	29.29	31.68	33.16	34.16	35.58	37.22	29.29	31.68	33.16	34.16	35.58	37.22
Mean	47.83	50.54	52.54	53.84	54.73	55.82	47.83	50.54	52.54	53.84	54.73	55.82
SEm ±	2.13	1.80	1.43	1.20	1.02	0.86	2.13	1.80	1.43	1.20	1.02	0.86
CD at 5%	6.39	5.47	4.29	3.60	3.06	2.59	6.39	5.47	4.29	3.60	3.06	2.59

Table 2 Root fresh weight (g), shoot dry weight (g) and root dry weight (g) of different lawn grasses at various growth stages

Treatments	Root fresh weight (g)						Shoot dry weight (g)						Root dry weight (g)					
	30	60	90	120	150	180	30	60	90	120	150	180	30	60	90	120	150	180
T_1	0.26	0.40	0.49	0.79	0.99	1.60	0.25	0.27	0.32	0.55	0.64	0.71	0.10	0.10	0.11	0.17	0.21	0.28
T_2	1.93	2.04	2.11	2.71	2.87	3.00	0.31	0.83	0.85	0.97	1.16	1.27	0.56	0.88	0.61	0.71	0.82	0.89
T_3	1.70	1.81	1.99	2.39	2.73	2.88	0.21	0.32	0.34	0.56	0.68	1.02	0.37	0.65	0.67	0.69	0.79	0.88
T_4	0.49	0.81	0.76	1.32	1.69	2.18	0.19	0.24	0.25	0.40	0.46	0.63	0.10	0.11	0.13	0.19	0.30	0.37
T_5	1.89	2.14	2.20	2.22	2.41	2.87	0.86	0.87	0.92	0.99	1.23	1.53	0.59	0.72	0.82	0.89	1.03	1.16
T_6	0.75	0.85	0.97	1.54	1.81	2.42	0.24	0.30	0.38	0.54	0.74	0.87	0.10	0.14	0.18	0.29	0.37	0.45
T_7	0.37	0.85	0.73	1.26	1.75	2.17	0.15	0.35	0.48	0.58	0.71	0.87	0.10	0.12	0.15	0.20	0.29	0.38
T_8	0.66	0.80	1.05	1.37	1.75	2.57	0.18	0.32	0.39	0.50	0.68	0.88	0.19	0.24	0.22	0.31	0.39	0.48
T_9	0.15	0.34	0.49	0.83	1.06	1.67	0.07	0.09	0.11	0.19	0.29	0.42	0.03	0.06	0.09	0.10	0.16	0.27
Mean	0.91	1.11	1.20	1.62	1.89	2.37	0.27	0.40	0.45	0.59	0.73	0.91	0.24	0.33	0.33	0.39	0.48	0.57
SEm ±	0.05	0.09	0.09	0.13	0.13	0.18	0.02	0.04	0.03	0.05	0.06	0.07	0.02	0.02	0.03	0.02	0.03	0.04
CD at 5%	0.15	0.28	0.27	0.38	0.38	0.54	0.07	0.12	0.09	0.14	0.17	0.21	0.07	0.05	0.09	0.06	0.10	0.11

Table 3 Root shoot ratio (Fresh weight basis) and Root shoot (dry weight basis)

Treatments	Root shoot ratio (Fresh weight basis)						Root shoot ratio (Dry weight basis)					
	30	60	90	120	150	180	30	60	90	120	150	180
T_1	0.48	0.52	0.59	0.68	0.76	0.83	0.43	0.40	0.37	0.32	0.34	0.41
T_2	1.10	0.72	0.93	1.11	0.97	0.89	1.47	1.06	0.73	0.74	0.72	0.72
T_3	1.14	0.89	1.05	1.04	1.07	0.95	1.75	2.08	1.96	1.26	1.17	0.89
T_4	0.49	0.54	0.50	0.76	0.86	0.87	0.55	0.45	0.52	0.49	0.67	0.59
T_5	0.66	0.71	0.78	0.78	0.75	0.81	0.69	0.85	0.89	0.91	0.85	0.76
T_6	0.58	0.50	0.48	0.65	0.69	0.79	0.46	0.46	0.49	0.55	0.51	0.51
T_7	0.42	0.52	0.49	0.51	0.62	0.67	0.69	0.34	0.31	0.35	0.42	0.44
T_8	0.53	0.49	0.38	0.64	0.58	0.74	0.74	0.76	0.56	0.63	0.57	0.55
T_9	0.67	0.73	0.81	0.71	0.60	0.74	0.45	0.70	0.80	0.54	0.56	0.65
Mean	0.67	0.62	0.67	0.74	0.77	0.80	0.80	0.79	0.74	0.64	0.64	0.61
SEm ±	0.07	0.07	0.07	0.07	0.07	0.05	0.18	0.08	0.07	0.07	0.09	0.07
CD at 5%	0.20	0.20	0.22	0.20	0.22	0.16	0.54	0.24	0.22	0.22	0.26	0.22

Root shoot ratio

The Root and shoot ratio of the different species presented in (Table 2-3). The data regarding observation on root shoot ratio was recorded during this course of investigation. It is seen from the data that there was significant difference between different species of lawn grasses. The data showed that the root to shoot ratio was maximum (0.95) recorded in Pensacola grass and least (0.62) root to shoot ratio recorded in Taiwan grass. The present investigation results are in line with findings reported by many research workers. [21] in perennial ryegrass (*Lolium perenne* L.) and reported that root: shoot ratio observed in growth chamber is (0.60) to control (0.73) and in greenhouse study root: shoot ratio is (1.84) to control (2.41) observed. Similar results founded by [22] in creeping bent grass (2.2, 1.8, 1.5). The average S: R of about 1.30 (values ranged from 1.01 to 1.72) in the first year and 0.60 (values ranged from 0.43 to 0.87) in the second year [23].

CONCLUSION

The experiment was conducted at Modibaug garden of Horticulture Section, College of Agriculture, Pune. The evaluation of nine lawn grasses species like viz. Argentine grass, Pensacola grass, Weeping love grass, Korean grass, and Bermuda grass, American blue grass, Taiwan grass and Phosphelone grass in this studied concluded that species Bermuda grass and American blue grass were found better for most of the quality of physiological parameters viz. chlorophyll content, shoot fresh weight, root fresh weight, root dry weight, root fresh weight and root shoot weight.

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