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T Deepikakrishnaveni
PG Scholar, Department of Floriculture and Landscape Architecture, Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

P Aruna
Associate Professor, Department of Floriculture and Landscape Architecture, Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

M Visalakshi
Assistant Professor, Department of Floriculture and Landscape Architecture, Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

MR Latha
Professor, Department of soil science and Agricultural Chemistry, Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

Corresponding Author:
T Deepikakrishnaveni
PG Scholar, Department of Floriculture and Landscape Architecture, Tamil Nadu Agriculture University, Coimbatore, Tamil Nadu, India

Standardization of mowing height and inorganic nutrient for establishment of *Zoysia matrella*

T Deepikakrishnaveni, P Aruna, M Visalakshi and MR Latha

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Abstract

An experiment was conducted to standardize the different mowing height and inorganic nutrients for better establishment of lawn grass *Zoysia matrella.* The experiment was laid out in Factorial randomized block design (FRBD) with 2 replications at Botanical garden, Department of Floriculture and Landscape Architecture, Tamil Nadu Agricultural University, Coimbatore. The Treatments included different mowing height (1 inch, 1.5 inch, 2 inch and 2.5 inch) and different level of inorganic nutrients *viz*., urea (50 g/m^2, 40 g/m^2, 30 g/m^2, 20 g/m^2) and Sulphate of potash (60 g/m^2, 50 g/m^2, 40 g/m^2, 30 g/m^2). In this experiment, observations were recorded on morphological and physiological parameters. The Morphological parameters included leaf length, internodal length, shoot length, root length, number of nodes per 10 sq cm. Physiological parameters included relative water content, total chlorophyll content and proline content. The result of this experiment was M2T3 observed better turf quality among different treatments. In the 45th and 60th day, M2T3 had highest record of leaf length (4.8 cm,2.65 cm), internodal length (2.45 cm,2.2 cm), shoot length (12.5 cm,6.7 cm), root length (4.0 cm,2.35 cm) and number of nodes per 10 cm sq (3,4 numbers) respectively. M2T3 recorded highest of relative water content (61.27%), Chlorophyll content (2.09%), and proline content (4.05 mg/g).

Keywords: Mowing height, inorganic nutrients, lawn grass, *Zoysia matrella*

Introduction

Zoysia matrella is a perennial, warm season grass which prefers both tropical and subtropical regions. It grows slowly and spread by rhizomes and stolons and also spread by seeds. It is popular on golf courses, commercial sites and home lawns etc., Because of their excellent wear tolerance, winter-hardiness, playability, and overall turf quality, it is used in a wider area and expresses salt tolerance. It generally needs less frequent cuts in comparison to the other types of grasses. *Zoysia matrella* grows as prostrate culms to 5 cm in height and 35 cm length. Leaves grow stiffly with the blades often curled, 3-8 cm long and 1.5-2.5 mm wide. The leaf sheaths are smooth with a membranous ligule and hairy throat. A well-established lawn of *Zoysia matrella* successfully fight against the weed by not allowing to penetrate into the green carpet of grass.

Fertilization of turf grass improves the quality of turf grass. It promotes medium to dark green grass and it also resist the pest and disease attack. It help to establish were in acid to neutral PH. The external application of nitrogen, phosphorus and potassium are required by the roots of turf grass for better growth and establishment. As the level of k is increased, less amount of Nitrogen is required for maximum quality (Christians, 1979) [1]. The presence of components of proteins, chlorophyll, amino acids, and coenzymes in nitrogen impacts the density, colour, disease resistance and stress tolerance of the shoot and root growth in turf grasses.

Proper mowing height improves the turf grass density and deep root system, too much of removing of turf leaves may also lead to long term damage of turf like disease, pest, drought and sunscald. Mowing height varies according the species used in lawn. Both criteria improves turf grass to be more stronger, which also promote better growth against weed and invasion of pest and disease and good establishment under adverse climatic condition.

Materials and Methods

The experiment was carried out at the Department of Floriculture and Landscape Architecture, Botanical garden, TNAU, Coimbatore, Tamil Nadu. The study was laid out under Factorial randomized block design with 2 factors and 2 replication. First factor consisted of 16 treatments which represents the different levels of inorganic nutrients (nitrogen and potassium) and the second treatment was different mowing heights (1 inch, 1.5 inch, 2 inch, 2.5 inch), mowing was done using self-propelled petrol lawn mower. The objective of the study is to conclude the better establishment of *Zoysia matrella* under different mowing height and different levels of inorganic nutrients (Nitrogen and Potassium).

Treatments	Factor -1 Mowing height	Factor -2 Inorganic nutrients (g/m^2)
M1T1	1 inch (2.5 cm)	50 urea + 60 SOP
M1T2	1 inch (2.5 cm)	40 urea + 50 SOP
M1T3	1 inch (2.5 cm)	30 urea + 40 SOP
M1T4	1 inch (2.5 cm)	20 urea + 30 SOP
M2T1	1.5 inch (4 cm)	50 urea + 60 SOP
M2T2	1.5 inch (4 cm)	40 urea + 50 SOP
M2T3	1.5 inch (4 cm)	30 urea + 40SOP
M2T4	1.5 inch (4 cm)	20 urea + 30 SOP
M3T1	2 inch (5 cm)	50 urea + 60 SOP
M3T2	2 inch (5 cm)	40 urea + 50 SOP
M3T3	2 inch (5 cm)	30 urea + 40 SOP
M3T4	2 inch (5 cm)	20 urea + 30 SOP
M4T1	2.5 inch (6.5 cm)	50 urea + 60SOP
M4T2	2.5 inch (6.5 cm)	40 urea + 50 SOP
M4T3	2.5 inch (6.5 cm)	30 urea + 40 SOP
M4T4	2.5 inch (6.5 cm)	20 urea + 30 SOP

Plot size of 1.5 m × 1.0 m was laid both in four lawn of Botanical garden, Department of Floriculture and Landscape Architecture, TNAU, Coimbatore. Observations on physical parameters and physiological parameters were taken on 45th and 60th day.

Results and Discussion

In this study, standarization of different mowing height and different of levels inorganic nutrients for better establishment of *Zoysia matrella* were studied. The results obtained on physical parameters, physiological parameters are discussed below.

Table 1: Effect of mowing height and inorganic nutrient on morphological parameters (45 days) for establishment of *Zoysia matrella*

Treatments	Leaf length	Internodal length	Turf shoot length	Turf root length	Number of nodes per 10 cm^2
M1T1	2.4	0.75	4.15	1.6	1.4
M1T2	1.9	0.8	4.6	1	1.4
M1T3	1.85	2.1	7.3	2.15	2.4
M1T4	2.5	1.65	7.45	2.2	2.0
M2T1	1.9	0.9	4.55	1.6	1.4
M2T2	1.8	1.5	4.65	1.45	2.4
M2T3	2.65	2.2	6.7	2.35	2.9
M2T4	2.25	1.6	5.3	2	1.4
M3T1	1.55	0.7	6.1	1.4	1.0
M3T2	1.85	1.7	6.2	1.7	1.3
M3T3	1.5	1.7	5.5	1.45	1.9
M3T4	1.45	1.8	5.25	1.9	2.4
M4T1	1.95	1.95	4.55	1.4	1.4
M4T2	1.8	2.1	5.5	1.85	2.4
M4T3	2.05	1.1	6.25	2	2.4
M4T4	2.4	1.25	5.65	1.65	1.4
Grand mean	1.98	1.4875	5.606	1.7875	1.8656
S ED	0.167	0.1366	0.2523	0.1807	0.2418
CD	0.356	0.2912	0.5378	0.5326	0.5154
Cv %	8.41	9.18	4.50	10.11	12.96

Table 2: Effect of mowing height and inorganic nutrient on morphological parameters (60 days) for establishment of *Zoysia matrella*

Treatments	Leaf length	Internodal length	Turf shoot length	Turf root length	Number of nodes per cm^2
M1T1	3.95	1.9	17.5	2.15	3.05
M1T2	3.1	1.55	9.35	2	2.95
M1T3	3.15	1.95	12.25	3.65	3.95
M1T4	4.5	2.15	11.75	3.95	2.90
M2T1	3.4	1.1	9.5	2.45	3.00
M2T2	3.3	1.4	8.45	3.8	3.90
M2T3	4.8	2.45	12.5	4	4.45
M2T4	4.3	2.1	10.55	3.95	3.00
M3T1	3.1	1.7	11.3	2.35	2.00
M3T2	4.1	2.1	11.2	3.15	2.00
M3T3	3.5	2	10.2	2.55	3.50
M3T4	2.95	1.4	8.35	3.75	3.90
M4T1	3.5	1.7	8.55	1.95	2.45
M4T2	3.4	2.35	11.55	3.15	3.95
M4T3	4	1.5	12.4	3.80	4.20
M4T4	4.1	2.25	9.9	3.10	2.95
Grand mean	3.7094	1.8500	10.4094	3.1281	2.8750
S ED	0.4092	0.1807	0.3712	0.8421	0.5701
CD	0.873	0.3852	0.7913	1.7949	1.2151
CV (%)	11.03	9.77	3.57	26.92	19.83

Table 3: Effect of mowing height and inorganic nutrient on physiological parameters (60 days) for establishment of *Zoysia matrella*

Treatment	Relative water content (%)	Total chlorophyll content (mg/g)	Proline content (mg/g)
M1T1	45.23	0.82	0.34
M1T2	52.30	0.71	0.32
M1T3	59.33	1.34	0.35
M1T4	57.57	0.73	0.31
M2T1	55.02	0.94	0.43
M2T2	53.83	1.26	0.41
M2T3	61.27	2.09	0.45
M2T4	58.30	1.89	0.39
M3T1	48.45	1.66	0.38
M3T2	50.81	1.13	0.34
M3T3	53.25	1.55	0.32
M3T4	50.57	1.33	0.35
M4T1	48.90	0.67	0.35
M4T2	51.83	1.30	0.34
M4T3	53.60	1.56	0.38
M4T4	49.00	1.24	0.33
Grand mean	53.0775	1.2628	0.3613
S ED	1.3215	0.0273	0.0157
CD	2.8168	0.582	0.0335
CV (%)	2.49	2.16	4.35

Leaf length

The leaf length shows significant difference among the treatments. On 45th and 60th day, the treatment M2T3 showed the longest leaf length of 2.65cm and 4.8 cm with a mowing height of 1.5-inch with a combination of urea (30 g/m^2) and single super phosphate (40 g/m^2), while M3T4 showed the shortest leaf length of 1.45 cm and 2.95 cm on 45th and 60th day after mowing by using a 2 inches mowing height and were treated with a mixture of urea (20 g/m^2) and sulphate of potash (30 g/m^2). This may be due to the optimum level of nitrogen and potassium which might have attributed for the growth and development of turf grass (Ihtisham, 2018) [7]. A stronger turf indicates more resilient and competitive against weeds to environmental challenges which results for improving proper mowing height in turf-grass.

Internodal length

The internodal length shows significant difference among the treatments. On 45th and 60th day, the treatment M2T3 showed the longest internodal length of 2.2 cm and 2.45 cm with a mowing height of 1.5-inch with a combination of urea (30 g/m^2) and single super phosphate (40 g/m^2), while M3T1 and M2T1 showed the shortest internodal length of 2.2 cm and 2.45 cm respectively on 45th and 60th day with using mowing height of 2.5 inches for M3T1 and 2 inches for M2T1 mowing height and were treated with a mixture of urea (20 g/m^2) and sulphate of potash (30 g/m^2). Under low-maintenance circumstances, internodal length is more important for determining lawn quality. (Tongumpai, 1991)

Turf shoot length

The Turf shoot length shows significant difference among the treatments. On 45th and 60th day, the treatment M2T3 showed the longest turf shoot length of 6.7 cm and 17 cm with a mowing height of 1.5-inch with a combination of urea (30 g/m^2) and sulphate of potash (40 g/m^2), while M1T3 and M1T1 showed the shortest turf shoot length of 4.15 cm and 5.4 cm on 45th and 60th day, with using mowing height of 1 inches for M1T3 and M2T1 mowing height and were treated with a mixture of urea (20 g/m^2) and sulphate of potash (30 g/m^2). N Significantly increased turf height and density, N promotes higher rate of photosynthesis, which also promotes higher growth rate. (Ihtisham, 2018) [7].

Turf root length

The Turf root length shows significant difference among the treatments. On 45th and 60th day, the treatment M2T3 showed the longest turf root length of 2.35 cm and 4 cm with a mowing height of 1.5-inch with a combination of urea (30 g/m^2) and sulphate of potash (40 g/m^2), while M1T2 showed the shortest turf root length of 1 cm and 2.1 cm on 45th and 60th day, with using mowing height of 1 inches mowing height for M1T2 and were treated with a mixture of urea (20 g/m^2) and sulphate of potash (30 g/m^2). Turfgrass growth, root formation, are all impacted by mowing. Deeper root systems are encouraged by higher cutting heights. Turf grass growth, root formation are all impacted by mowing. Deeper root systems are encouraged by higher cutting heights. The more open canopy and lower shoot density cause taller turf. The root system is decreased in length by lowering the mowing height. This limits the turf grass capacity to absorb nutrients and water.

Number of nodes per 10 Sq cm

There was no significance difference in the number of nodes per 10 sq cm among different treatments and were observed.

Physiological parameters

Relative water content

The Relative water content shows significant difference among the treatments, highest relative water content percentage was recorded by M2T3. It showed the highest value of 61.27%, lowest relative water content percentage was recorded by M1T1. It showed the lowest value of 45.23%.

Kaiser (1987) reported that as RWC falls, a permanent reduction in plant photosynthetic ability takes place, resulting in chloroplast membrane damage that makes the plants more vulnerable to drought stress. Due to its low RWC, *Axonopus compressus* has a lower tolerance for drought stress. Turf relative water content can be used to determine the strength and health of a plant to a significant extent (Jyoti, 2012) [9].

Total chlorophyll content

The Total chlorophyll content shows significant difference among the treatments. It was determined by using acetone method and the readings were determined by using spectrophotometer @ 663 nm and 645 nm. Highest total chlorophyll content was recorded by M2T3 and the lowest total chlorophyll content was recorded by M4T1. (Liu and Huang, 2000) When there is a drought, chlorophyll is crucial for preserving photosynthesis. The ability of warm season grasses to withstand heat stress is shown by their higher chlorophyll content. The chlorophyll content of grasses can be used to identify mowing damage. All of the turfgrasses under study had necrotic and brown tissue that was brought on by mowing due to the deterioration of the chlorophyll content in the leaves. This finding is consistent with that of (Howieson, 2001).

Proline content

The proline content shows significant difference among the treatments. Highest proline content was recorded in the treatment M2T3. It showed value of 0.45 mg/g and the lowest proline was recorded in the treatment M1T4. It showed value of 0.31 mg/g. Hence M2T3 (mowing height of 1.5 inch and application of 30 g/m^2 of urea and 40 g/m^2 of sulphate of potash might have more water stress tolerance capacity. One of the ways that plants overcome the consequences of water stress is by proline buildup. (Cattivelli, 2008) [3]. Through the dehydration of protoplasm, proline induces stress tolerance in plants. It serves as a compound for storing carbon and nitrogen. It is suggested that proline may also protect protein configuration during stress and dehydration. Proline accumulation is to reduce the osmotic potential in order to maintain the plant turgor pressure. (Fernandez, 2006).

Conclusion

The finding and interpretation from the present study concluded that optimum mowing height and inorganic nutrients would improves the turf quality. From the above results, 1.5 inch mowing height and 30 g/m^2 of urea and 40 g/m^2 of sulphate of potash (M2T3) improved turf quality

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