

Song, J. H. et al. THE EFFECT OF MICROORGANISMS DRENCH ON THE LEAF COLOR OF GOLF COURSE GRASS

The Effect of Microorganisms Drench on the Leaf Color of Golf Course Grass –Targeting Jeju Ecoland–

Song, J. H.^a, Lee, M. S.^a, Moon, S. H.^b, Kim, Y. S.^c, and Shin, S. E.^{d*}

^aGreenBio-Agro Company, KOREA

^bThe Won Company, Ecoland Golf and Resort, Dept. of Course Management, KOREA

^cDept. of Environmental GreenDesign&Horticulture, Sahmyook University, KOREA

^dSahmyook Environmental GreenDesign Research Institute, Seoul, KOREA

*greencolor@syu.ac.kr

ABSTRACT

The adjustment of growth and color through the use of microorganisms has mostly been applied to agricultural and fruit trees and such studies with respect to flower color began only recently. Microorganisms are used even in a golf course that people use directly, for various purposes, such as for improved growth of grass and for inhibiting the diseases of the grass, and the effects of the treatment are more than expected. However, the leaf color of grass has not been assessed in most of such studies. Therefore, in this study, we evaluated the effect of microbial drenching on the color of golf course grass so as to propose a method for future use. We visited Eco Land, a pesticide-free eco-friendly golf course, located in Jeju Island five times from September to November 2016 and divided it into areas A and B based on the bentgrass species, for comparative color analysis after different treatments. The area A was not treated with microorganisms and the area B was treated with microorganisms; the digital color analysis using raw files was performed together with colorimetry, visual analysis through RHS color sampling and Color Checker. It was observed that the leaf color in the microbial treatment area (area B) was clearer and darker than that in the leaves from the area with no microbial treatment (area A), even though the plant species and varieties as well as the environmental conditions were same. In addition, the YG series (area A) of no microbial treatment section appeared in the RHS visual analysis, whereas the microbial treatment section (area B) was closer to the G series. Because of the effect of various factors, such as weather and soil condition, a follow-up study that can reveal the correlation between microorganism drenching and grass leaf color is needed. In addition, it is necessary to study the various unique colors of grass leaf according to the plant species and varieties. It is expected that ecological golf courses and theme parks will coexist because of the unique environmental characteristics of Jeju, presence of Gotjawal forest, and the microbial stump treatment, which excludes chemical pesticides.

KEYWORDS: Microorganisms, Plant(Leaf/Turf) Color, Ecofriendly Grass Management

INTRODUCTION

Most research regarding the effects of microorganisms on plant growth and color have focused on agriculturally important species. However, several recent studies have also reported the effects of microorganism treatment on flower color (Park-Giyoung et al, 2010; Kim-Yoosun, 2013). For example, microorganism treatment was effective in changing the color of cyclamen flowers and could be used to improve the quality of potted flowers and thereby profit farmers. In addition, microorganism treatment has also been reported to improve golf courses by improving growth and providing protection against pest insects (Kim-Youngsun et. al., 2016). However, the effect of microorganism treatment on the color of turf has yet to be examined.

THEORY

Ecoland is located in Beonyeong-ro, Jeju-si, Jeju-do, Republic of Korea and has incidental facilities, such as a theme park, a golf course, and a resort. It is situated at Jeju Gotjawal, which is a unique geographic area characterized by volcanic activity, abundant groundwater and flora, overall beauty, and ecological value. Moreover, Ecoland is well known for its environment-friendly golf course, which is carefully supervised by the local government since the area is inhabited by endangered fauna and flora. Meanwhile, the Ecoland theme park is famous for beautiful scenery and a train ride.

EXPERIMENTAL

1. Research Materials

The present study used a variety of western bent grass (i.e., ALPHA) that is commonly used on golf courses, as well as seven microorganisms: (Cillus, Nospot, Eksangkanto, Acre, Tricogold, Solbikche, and Greenallteck), which are further described in the table below. The turf was topdressed with the microorganisms from the middle of March to the middle of November, at intervals of ~15 d. Methods of research are different to the condition of green. From March to June and from September to November, a study was proceeded by multi-reagent, and irrigation works make a progress during 2-3 min after fertilization. The amount of irrigation varied according to the weather and turf conditions. A work study around noon should be avoided because microorganisms are vulnerable to sunlight. A fertilizer is under control with low nitrogen (15-18 annually).

Table 1. Types and Ingredients of Microorganisms used in Jeju Ecoland

Product Name	Guaranteed Component
Cillus	10^7 Bacillus subtilis GB0365 3.0x cfu/ml
Nospot	10^7 Bacillus subtilis EW42-1 3.0x cfu/ml
Eksangkanto	10^7 Bacillus subtilis GB-017 1.0x cfu/ml
Acre	10^7 Simplicillium lamellicola BCP 5.0x cfu/g
Tricogold	10^7 Trichoderma harzianum GBF0208 1.0x cfu/g
Solbikche	10^7 B.t.subsp.aizawai GB413 1.0x cfu/ml
Greenallteck	Bacillus subtilis EW42-1 · CJ-9 · GB0365, Trichoderma harzianum GBF0208, Yeast, Lactobacillus, Saccharomyces, Aspergillus, Rhodobactor and so on

2. Research Range and Methods



Figure 1: Zone A(control plot).



Figure 2: Zone B(treatment plot).

The research range included two zones (A and B) of bent grass at Ecoland that were studied during five visits over 3 months (from September to November 2016). Zone A was used as the control plot, and zone B was subject to microorganism treatment. This study was a comparative analysis.

After treatment, the turf color was analyzed using a color meter (MRM200QC of X-rite), RHS Color Charts (5th edition), and color checker, which can process the raw digital image files of the Panasonic Lumix (PKL-LX2) and Photoshop Lightroom.

Table 2. Total Annual Use of Microorganism used in Jeju Ecoland(kg=L)(From March to November 2016)

Song, J. H. et al. THE EFFECT OF MICROORGANISMS DRENCH ON THE LEAF COLOR OF GOLF COURSE GRASS

Month	Cillus	Nospot	Eksang-kangto	Acre	Tricogold	Solbikche	Greenall-tech	Total
March	100	-	100	-	20	-	-	220
April	200	100	200	20	40	-	880	1440
May	200	200	200	40	40	60	880	1620
June	200	200	200	40	40	-	-	680
July	200	200	200	40	40	60	-	740
August	200	200	200	40	40	60	-	740
September	200	200	200	40	40	-	880	1560
November	200	200	200	20	40	-	-	660
December	100	100	100	-	20	-	-	320
Total	160	1400	1600	240	320	180	2640	7980

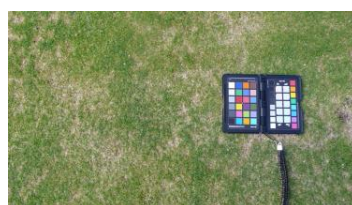


Figure 3: Analysis by RHS Color charts. Figure 4: Analysis by Color checker. Figure 5: Analysis by Color meter.

RESULTS AND DISCUSSION



Figure 6: RHS Color of Zone A.

Figure 7: RHS Color of Zone B.

In the present study, the color of the turf in zone B was deeper and more vivid than that of other turf species and varieties grown under the same environmental conditions. The difference between the color of zones A and B were glaringly obvious to the naked eye, and the turf of zone A was associated with the YG series of colors, whereas the turf of zone B was associated with the G series of colors.

Table 3. The Value of the Color for Untreated control Zone(zone A) and the Treatment Zone(zone B)

	Primary		Secondary		Tertiary		Quaternary	
	Zone A	Zone B	Zone A	Zone B	Zone A	Zone B	Zone A	Zone B
L	33.8	30.8	43.8	36.9	47.6	30.2	39.2	32.6
a	-5.0	-4.0	-0.7	-3.2	-4.1	-4.9	-4.4	-7.9
b	20.0	31.8	25.1	21.8	23.3	19.0	20.0	20.0
C	20.6	34.9	25.1	22.1	23.6	19.6	20.4	21.5
H	104.1	114.5	91.7	98.3	100.1	104.4	102.3	111.5
Color chip								

Standard Light	D/65	D/65	D/65	D/65	D/65	D/65	D/65	D/65
RHS	G 137C	G 137C	YG 144A	G 137C	YG 146B	G 137A, N 137D	YG 146A	G 137B

CONCLUSION

The present study examined the effect of microorganism treatment on the color of turf on a golf course in Ecoland, Jeju. The study predicted that both plant growth and leaf color would be improved by multi-fertilization with irrigation of microorganisms, and the study's results supported this hypothesis. However, because the present study failed to account for the influence of other factors on turf color, such as the soil and weather conditions, a follow-up study is recommended, and future studies should also address the variation of color among turf varieties.

As an environment-friendly golf course, Ecoland is a significant research subject. For these reasons, the present study is suggestive because agricultural chemicals are not used in this area. The present study shows that plant growth can be improved by treatment with microorganisms, as an alternative to chemicals, and the results are applicable to the management of both golf courses and theme parks.

ACKNOWLEDGEMENTS

We are very grateful to Sahmyook Environmental GreenDeisgn Research Institute that offered its cooperation on this thesis.

REFERENCES

- [1] Kim, Y.S. 2014. *Analysis of Cyclamen(Bright Red) Fower Color of Potted Plants Treated with Microorganisms under Light Source*, Journal of Korea Society of Color Studies 28(3) 93-101.
- [2] Kim, Y.S., Lee, C.E., Ham, S.K. and Lee, K.J. 2016. *Growth of Creeping Bentgrass by Application of Compound Fertilizer Containing Microbes*, Weed & Turfgrass Science 5(1) 42-50.
- [3] Kim, Y.S. and Park, Y. S. 2013. *Effects of Rhizosphere Microorganisms Drench on Growth Development and Flower Color of Potted Cyclamen persicum Mill. 'Salmon with Eye'*, Journal of Korea Society of Color Studies 27(1) 13-22.
- [4] Lee, J.J., Kim, Y.S., Ham, S.K., Lee, C. E. and Lee, K.J. 2015. *Growth and Quality Improvement of Creeping Bentgrass by Two Fertilizer Containing Tricoderma Species*, Weed & Turfgrass Science 4(3) 249-255.
- [5] Park, K.Y. and Kim Y.S. 2010. *Effect of Microbial on Flower Color and Pot Quality of Pot Cyclamen*, 24(3) 27-34.