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The Shade Tolerance of Korean Lawngrass (*Zoysia japonica* Steud.)

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韓國잔디의 耐陰性에 관한 硏究

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SUMMARY

This experiment was conducted to study on the morphological change and growth retardation of Korean Lawngrass (*Zoysia japonica* Steud.) under various shading degrees. Dada of plant height, No. of tiller, No. of stolon, No. of rhizome and fresh weight were measured on the 147days after transplanting in 1991.

The results are summarized as follows.

Plant height was increased at 30% shading degree or over, Maximum plant height was observed at 60% shadeing degree which was 24.2 cm. while full sunlight(control) was most shorted as 10.1 cm. Plant height rapidly was increased as to shading degree increase.

The decreasing rate was lower in tiller number and stolon number(top parts of plant) compared with the rhizome number(under ground part) was severely decreased at 30% to 60% of shading. To increase the shading degree, rhizome number was most severely decreased under shading degrees. As degree of shading increase to 30%, 60% and 90%, fresh weight decrease to 66%, 44%, 22% to full sunlight, respectively.

Relative growth retadation of Korean lawngrass was decreased by the order of number of rhizome, fresh weight, number of tiller, number of stolon. And these characters were highly significant according to the different shading degrees.

Ⅰ. Introduction

Korean lawngrass(*Zoysia japonica* Steud.) grow in wild fields and mountains, costal area, tomb and play-grounds. They are now distributed throughout warm humid and transitional climates regions. *Zoysia japonica* Steud. is resistant to weed invasions, disease and insect damages. It is relatively drought wear and high to close mowing. It is coarse in texture but desirable for home lawn use and excellent for large areas such as play-ground and erosion control.

Generally, long daylength tended to produce more roots, stolons and rhizomes(Moser, 1968). Yeam(1984) revealed that *Zoysia* plants need both a certain stage of maturity and a stimulation by specific environmental conditions such as short day etc., for flowering. The morphological course of inflorescence development was similar in most grasses, but its timing and environmental requirements varied greatly with the species and varieties, being closely related to the climatic and agronomic origin of material(Cooper, 1963).

Zoysia japonica Steud. is neither harmful feed for domestic animals nor succulent that is adequate to lie down on the grass.

The amount of light received by turfgrasses is influenced by many factors in the environment. Clouds, buildings, trees can reduce light intensity through shading. With moderate shading, turfgrass leaf blades typically assume a more uplight orientation as if they were 'reaching up' for more light.

Additional effects of reduced light include; thinner, longer leaves; reduced shoot density and tillering; shallower rooting; thinner cuticles ; and lower reserve carbohydrates within the plants. A 'shade' turf is thus more delicate and less tolerant of disease and other environmental stress.

Zoysia japonica Steud. is most popular turfgrass and C_4 plants which demand strong light intensity. Lawns are a major part of most home landscapes therefore, the lack of light in home and commercial landscapes environmetals where some degree of shading exists.

This study was designed to define that shade tolerance of Korean lawngrass by the shading degree with pot experiment in Seoul districts.

Ⅱ. Materials and Methods

This experiments were conducted at the campus of Korean Sham Yook University during period 26 May to 19 October in 1991. *Zoysia japonica* Steud. plant materials were sampled in campus lawn with 'Hole Cutter' sampler which has 10 cm-diameter and 10 cm-depth. Transplanted plastic pot with upper diameter is 23 cm, and height is 22 cm. Used soil properties in this experiment is showed Table 1.

Light treatments were made by different shading degree(full sun light, 30%, 60% and 90% respectively) with black polyester shade cloth fastened onto wooden frames and suspended 1.5 m above the soil level.

Pot were dipped about three quarter under soil surface. Watering and weeding were done frequent, if necessary. During the growing period, neither fertilizering nor mowing were done. Plant height fresh weight and, number of tiller, stolon and rhizome data were collected on the 147days after transplanting to pot.

The experiment was arranged in a complete randomized plot design using 4 treatments and 10 replications.

Ⅲ. Results and Discussion

Table 1. Chemical properties of soil at experiment field.

Sampling depth (cm)	pH	Organic matter (%)	Available P (ppm)	Exchangeable cation (me /100g)		
				K	Ca	Mg
0~10	6.0	1.56	662	0.265	2.478	0.498

Table 2. Effect of different shading degrees on plant height, tiller numbers, stolon numbers, rhizome numbers and fresh weight in Korean Lawngrass (*Zoysia japonica* Steud.)

Percentage of shading degree(%)	Plant height(%) (cm)	Fresh weight(%) (g)	No. of tiller(%) (ea)	No. of stolon(%) (ea)	No. of rhizome(%) (ea)
0(Control)	10.1[b](100)	62.5[a](100)	205.6[a](100)	18.6[a](100)	12.8[a](100)
30	21.0[a](208)	65.6[b](66)	143.6[b](70)	15.8[a](85)	5.6[b](44)
60	24.2[a](240)	40.8[c](41)	80.6[c](39)	8.2[b](44)	4.6[b](36)
90	22.1[a](219)	21.6[d](22)	54.8[d](27)	7.2[b](39)	2.0[c](16)
F-value	11.6**	11.3**	35.4**	11.6**	18.9**
LSD(0.05)	3.8	2.9	23.4	3.5	9.9

Shadeing degrees were control(full sun light), 30%, 60% and 90% in *Zoysia japonica* Steud. Plant height fresh weight, and number of tiller, stolon, rhizome data were collected on the 147days after transplanting.

1. Plant height

Fig. 1, 2 and Table 2 show the relationship between shading degree and plant height in *Zoysia japonica* Steud. Maximum plant height was observed in 60% shadeing degree which was 24.2 cm in this experiment, while control showed minimum height as 10.1 cm.

Plant height rapidly increased as to shading degree incresed. But, in case of severely shading degree(90%) shortened plant height.

Shoot growth showed significant difference between control and other treatment. However, not significant among treatments(30~90%).

This experiment conclude that average plant height rapidly increased under shading treatment to the extend of 60% shading degree. The shading degree treatment is over 60%, plant height trend to decrease.

According to Park's experiment(1984), the effect of seedling growth and varieties in major forage were showed that plant height increased from 0% to 50%, but that decreased in 75% and over shading degree.

2. Number of tiller

The effect of shading on tiller number is shown in Fig. 3 and Table 2.

Tiller number dramatically decreased under severe shading degree, and showed highly significant among treatments.

Beard(1965), Dexer(1942) and Mitchell (1955) observed shoot intensity has a positive correlation with photosynthesis potential which contributed to plant growth. It means that sod compactiness decrease by shading conditions and reduced light intensity effect negatively on turf quality.

Sod compactiness and shading treatment were lower than control. So, lawn quality worse.

3. Number stolon and rhizome

Effect of shading degree on stolon number and rhizome number is shown in Fig. 4, 5 and Table 2, respectively. Stolon number begin to slowly decrease 30% shading degree while rhizome number rapidly decreased under 30% shading degree. This maybe agreed on Yu (1970) reported internode length shortened by

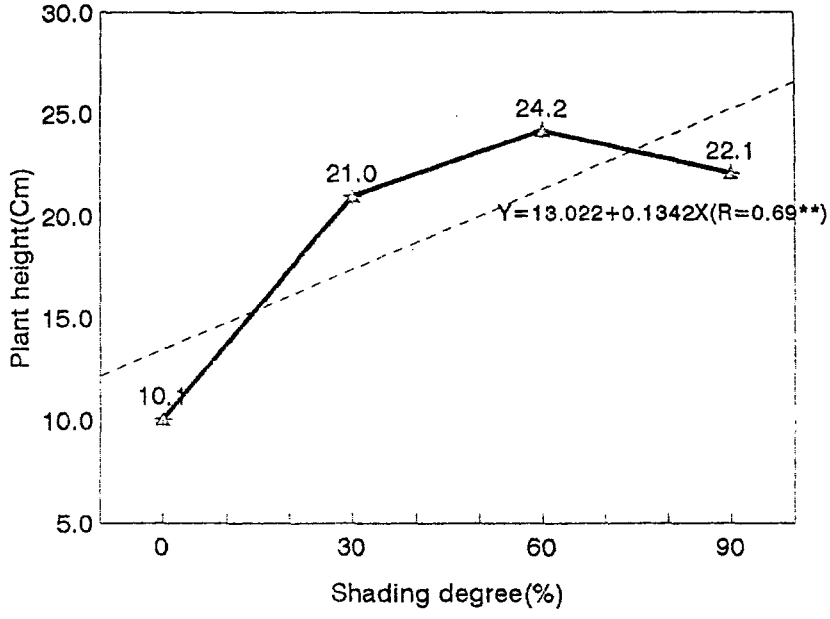

Fig. 1. Change of plant height in Korean Lawngrass (*Zosia japonica* Steud.) according to different shading degree

shading. Among the collected data, relative decreasing ratio of rhizome number was most severe under reduced light intensity. The reason maybe explain that *Zoysia* is C_4 plant which need strong light intensity. Additional research is necessary to refine the reason why the underground part of rhizome resulted severe damage than upper ground parts.

4. Fresh weight

The effect of shading on fresh weight is shown in Fig. 6, 7 and Table 2.

Fresh weight greatly decreased according to shading degree and all treatment were significantly difference at 5% level. The major reason of differences seemed due to total growth retard not only top fresh weight(plant height, No. of stolon, No. of tiller) but also root fresh weight(No. of rhizome).

According to Mantel(1966), restricted lighting influenced dry weight, plant density, chrolopyll content and visual rating intrarelated. As similar conclusion with Mantel under light intensity, most plant growth characters were better except plant height.

Conclusionally, this experiment may suggest that permitted shading level (such as buildings, fence, trees and planting slope) was over 30% shading degree.

Morever, The less shading condition, the better growth in *Zoysia japonica*. Steud. As C_4 plant consider this fact when lawn establish and maintenance.

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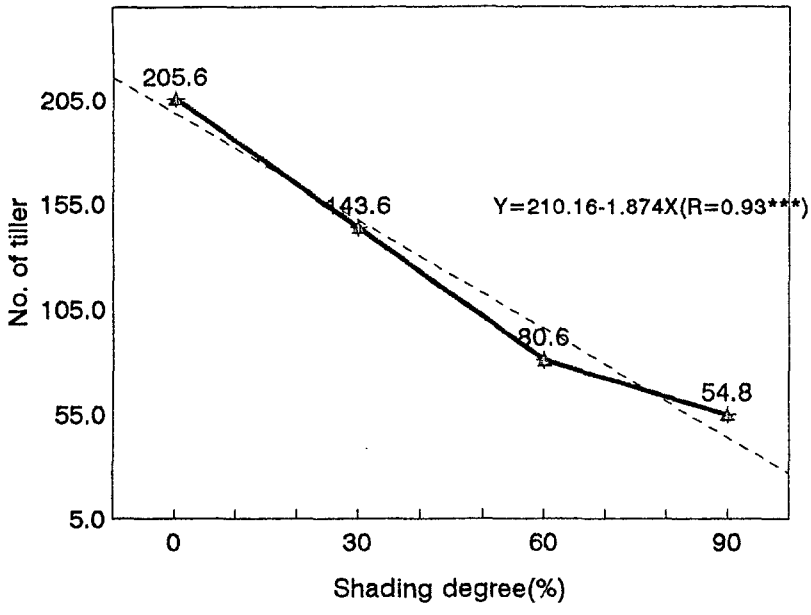

Fig. 3. Change of No. of tiller in *Zoysia japonica* Steud. according to different shading degree

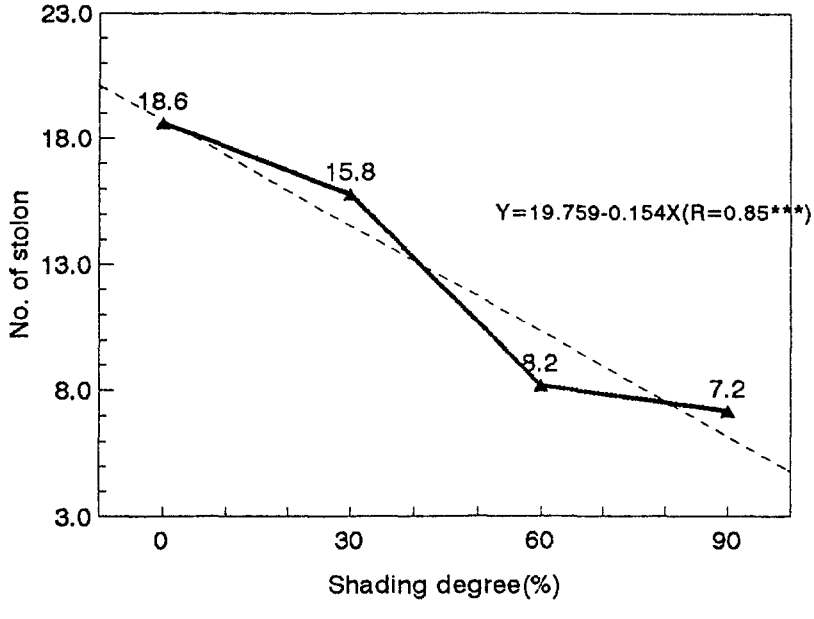

Fig. 4. Change of No. of stolon in *Zoysia japonica* Steud. according to different shading degree

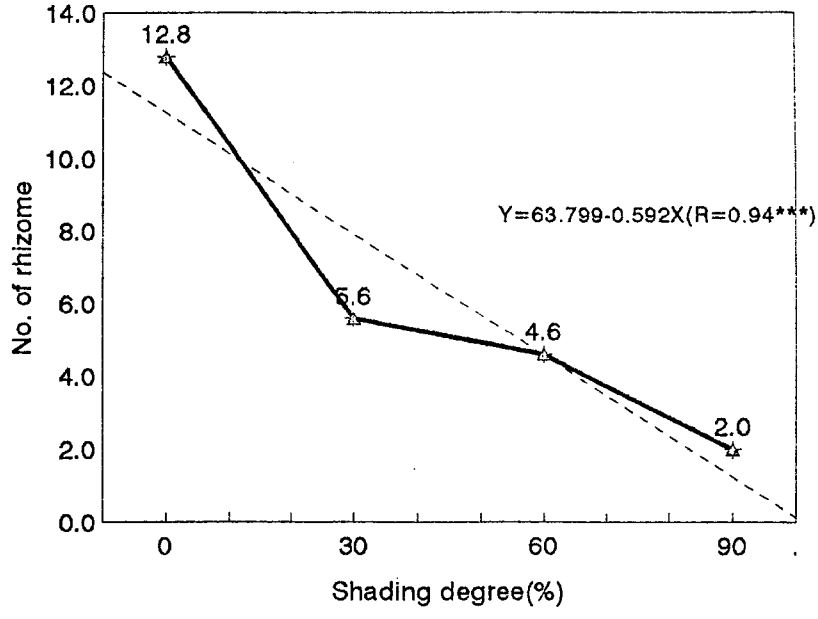

Fig. 5. Change of No. of rhizome in *Zoysia japonica* Steud. according to different shading degree

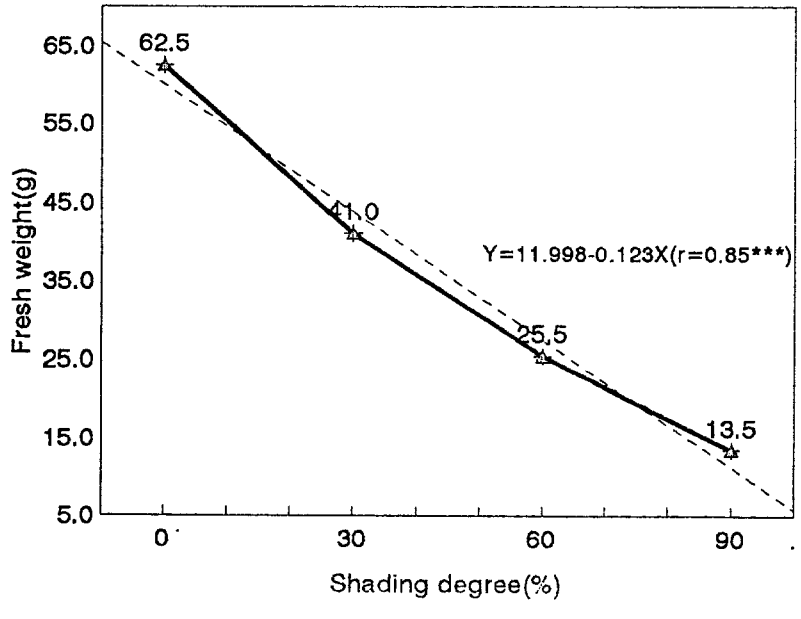

Fig. 6. Change of fresh weight in *Zoysia japonica* Steud. according to different shading degree

Fig. 2. Photographs on plant height of *Zoysia japonica* Steud. grown by different shading degrees.

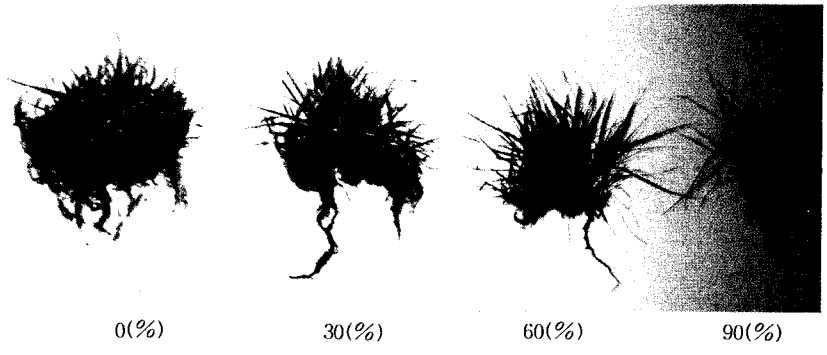

Fig. 7. Photograph on fresh weight of *Zoysia japonica* Steud. grown by different shading degrees.

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