Zoysiagrass Establishment From Seed

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THE RECENT development of a successful seed treatment assuring rapid zoysia establishment is certain to create greater interest in this turfgrass species. Generally, in the past, this excellent warm-season turfgrass has been established vegetatively, mainly because seed germination has been poor (less than 60 percent) and very slow (up to several weeks), even after mechanical scarification. Now, with base scarification and a follow-up light treatment, zoysia seed will germinate over 85 percent in seven days.

This new treatment technique was developed in Korea by Drs. T. Y. Yu, D. Y. Yeam, and co-workers. Dr. Yeam enjoyed sabbatical leave in 1978-79 and worked as a research associate at the United States Department of Agriculture's Beltsville research station and at Southern Illinois University at Carbondale. Because of limited import, he brought untreated Korean zoysiagrass (*Zoysia japonica* Steud.) seed to assure that he could display and further refine his treatment procedures while here.

Initial seed treatment consists of soaking seed in a potassium or sodium hydroxide (KOH or NaOH) solution. After testing various concentrations and soaking durations, it was determined that soaking the seed in a 30 percent solution for 25 minutes gave the best results, 95.3 percent germination in seven days under light conditions.

For rapid germination under conditions similar to those found in the field, a light treatment prior to seeding is needed. Imbibed seeds are treated for 36 to 48 hours with sunlight or fluorescent light. Test results using different lengths of fluorescent light treatment are shown in Figure 1. The seed subjected to the KOH seed scarification treatment resulted only in 30 percent germination in seven days, but when this seed was also subjected to a light treatment for 36 to 60 hours, germination increased to 70 percent, even in the dark.

FIGURE 1
Germination after KOH and Different Light Treatments
7 Days at 30-35° C, Dark Conditions, Petri Dishes

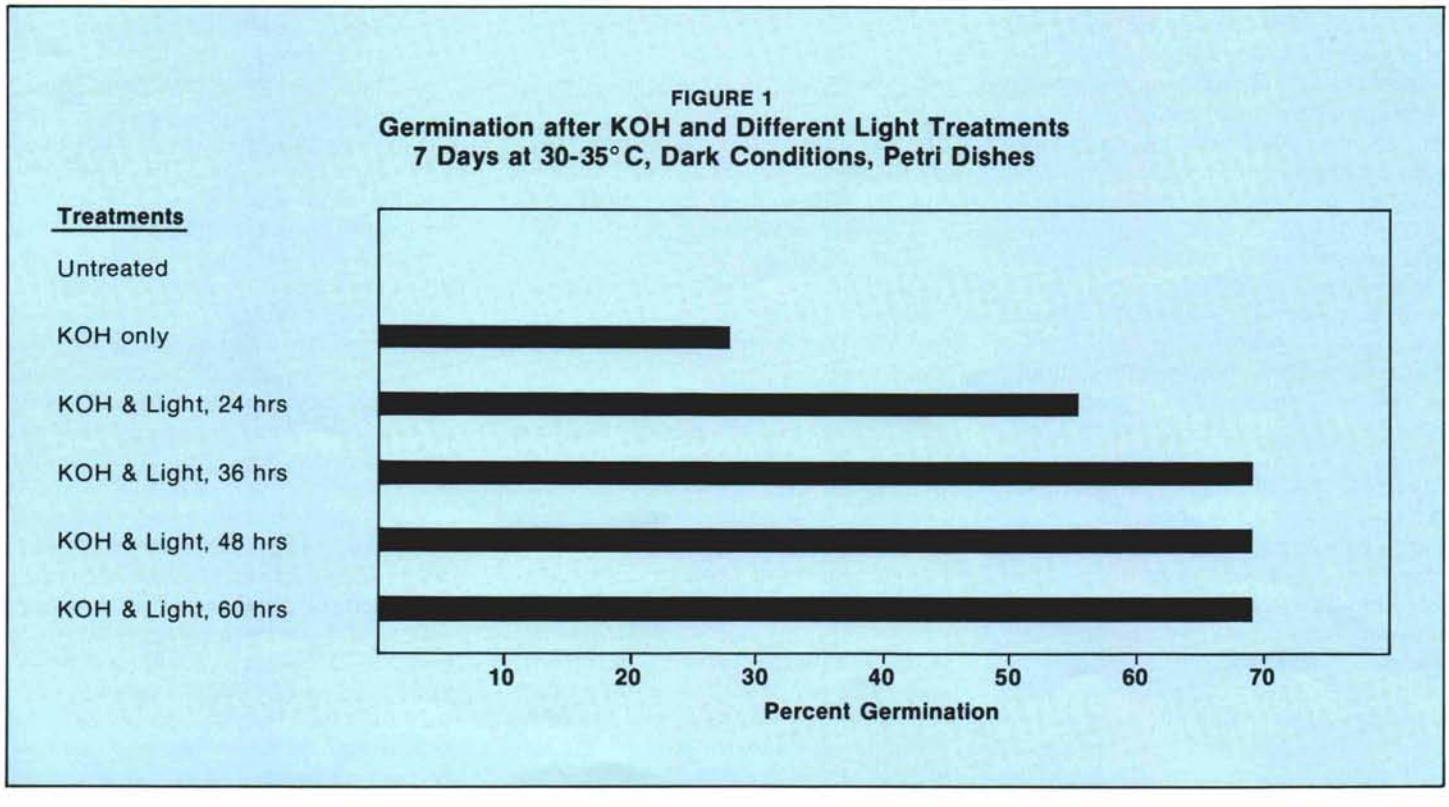

TABLE 1
Seed Treatments and Seeding Methods and Resulting Ground Cover of Zoysiagrass at Two Locations in 1980

Seed Treatment	Seeding Method	Ground Cover		
		USDA-B	SIU-C	
		3 Weeks	5 Weeks	12 Weeks
		%		
U	BR	3.0 b*	6.7 e	51.7 b
U	SR	2.0 b	5.0 e	48.3 b
U	RS	3.0 b	8.3 e	51.7 b
S	BR	51.7 a	48.3 b	88.3 a
S	SR	58.3 a	70.0 a	90.0 a
S	RS	7.0 b	25.0 cd	81.7 a
SL	BR	66.7 a	78.3 a	91.7 a
SL	SR	56.7 a	80.0 a	85.0 a
SL	RS	6.0 b	36.7 bc	81.7 a

U = untreated; S = scarified; SL = scarified and light.
BR = Brillion rolled; SR = smooth rolled; RS = Roger's seeder.

*Means within columns followed by the same letter are not significantly different at the 5% level as determined by Duncan's multiple range test.

Immediately following the light treatment, it is important to dry the seed at relatively high temperatures (above 30° C), because any delay will cause seed subjected to these treatments to sprout. Rapid drying and storage at low temperatures (0 to 40°C) is necessary to retain seed viability.

It was also determined that temperatures of 30 to 36°C gave best germination, which indicates that the zoysiagrasses must be seeded in late spring or summer. Prior to seeding, an additional seed soak of 24 hours further enhanced the speed of germination. This procedure fits especially well when using a hydroseeder.

SEED CHARACTERISTICS of zoysia that are responsible for seed dormancy differ from those of most turfgrasses. A hard, waxy outer glume develops around the caryopsis (seed). This hard seed covering must be scarified or removed before normal germination occurs. A reduction in seed size from almost 3mm in length to less than 2mm is noted after KOH scarification and dehulling. Following scarification, light and perhaps water and oxygen can then penetrate and change the internal hormone balance which causes the embryo to begin its germination process. This light response is a phytochrome reaction triggered by red light, and is unique also to lettuce and some weed seeds. Sunlight or white light from a fluorescent bulb each contain sufficient red light to trigger this phytochrome reaction. Although as little as two minutes of light is probably adequate, the seed needs to continue the pregermination process until it is no longer reversible, hence a 36- to 48-hour time period is needed. Low or alternating temperatures can partially substitute for this light.

Perhaps most intriguing in the entire germination process are the internal hormonal changes required to bring about germination. It has been shown by Dr. Yeam and co-workers that there is a decrease in an abscisic acid-like substance and an increase in a gibberellic acid-like substance in zoysia seed after the KOH and light treatments. The actual effect of the base KOH or NaOH solution on the seed cover is still being investigated. Also, the quantity and quality of light needed, as well as the effect of temperature on breaking seed dormancy still need more research.

FIELD ESTABLISHMENT of Korean zoysiagrass seed was begun at several locations in 1980. At Carbondale and Beltsville, experiments were conducted on seeding methods and rates. Untreated (U), KOH-scarified (S), and scarified and light-treated (SL) seeds were used in a seed treatment/seeding method experiment. Percent ground cover from a uniform seeding rate of 1½ pounds per 1,000 square feet and three seeding methods are

TABLE 2
Seeding Rates for SL Seed and Resulting Ground Cover at Two Locations in 1980

Seeding Rate		Ground Cover		
		USDA-B	SIU-C	
m^2	1000 ft^2	3 Weeks	5 Weeks	12 Weeks
g	lb	%		
1.25	¼	40.0 b	68.3 b	86.7 a
2.50	½	58.3 b	70.0 ab	88.3 a
3.75	¾	68.3 ab	81.7 ab	88.3 a
5.00	1	71.7 ab	80.0 ab	90.0 a
7.25	1½	83.3 ab	83.3 ab	90.0 a
10.00	2	91.7 a	86.7 a	90.0 a

shown in Table 1. The SL treated seed gave the highest percent ground cover when rolled with the Brillion and a smooth roller after broadcast seeding. The non-light treated seed (S) was slower to emerge when Brillion rolled and especially when drilled as compared to being smooth rolled because of soil coverage and subsequent light exclusion. In 12 weeks, however, a ground cover of 80 to 90 percent was obtained from all but the untreated seed.

In the seeding rate experiment, the SL treated seed was broadcast at rates from ¼ to 2 pounds per 1,000 square feet. (See Table 2.) There was a significant difference between the ¼- and 2-pound rate at both locations at three and five weeks. At 12 weeks, however, there was no difference between seeding rates at Carbondale. The low rate of ¼ pound was slower to establish, and considering the problem of uniform seed distribution and possibly less than ideal weather or irrigation conditions, one should consider a seeding rate of ¾ pounds or higher for planting and weather insurance.

Weed control treatments in connection with seedling establishment were first tested in greenhouse trials, and siduron gave minimum zoysia toxicity and good weed control. Field trials subsequently have further confirmed the feasibility of using siduron for preemergence annual grassy weed control. The granular formulation of siduron was found to be slightly more phytotoxic to zoysia seedlings than the wettable powder water solution of equivalent strength. The previously described method and rate experiments also received a treatment with eight pounds active ingredient (a.i.) per acre of 50 WP siduron. Broadleaf weeds were controlled with postemerge applications of 2,4-D at ¾ pound a.i./acre and dicamba at ¼ pound a.i./acre.

Hydroseeding is being tested with excellent initial results. During the dry, hot summer of 1980, without follow-up irrigation, however, seedlings succumbed to the drought despite the turf fiber mulch. Hydroseeding is extensively practiced in Korea.

SEED PRODUCTION prospects for most zoysiagrass cultivars look promising. Seed is normally ready to harvest between June 15 and July 15 at Carbondale. The spike-like heads are easily hand harvested, the way it is done in Korea by older women and school children. Seed spikes can also be harvested with shears. Mechanical harvesting is now being researched in this country.

The major problem of adapting specific cultivars, such as *Meyer* zoysia, to seed production and use is that they do not breed true. Meyer notably segregates and seedlings display diverse growth habits from seed. There could also be problems of sterility and low seed yields. Midwest seedlings were phenotypically more uniform. Also, the Common zoysia seed presently imported from Korea displays considerable variation in seedling progeny.

A strong zoysiagrass breeding program is needed to develop new cultivars that can be propagated by seed. J. J. Murray, USDA-SEA, already has such a program underway. Midwest and Korean establish more rapidly, have a coarser leaf texture and longer internodes than Meyer or Emerald zoysia. With new germplasm and careful selection, cultivars may be developed for specific use and increased insect and disease tolerance. Presently chinch bugs and billbugs are the most serious insect pests, while rust, brown patch, and Fusarium blight are diseases that have been observed on zoysiagrasses.

MANAGEMENT practices applicable to Meyer may not suit Korean or other coarser types of zoysia. Preferably low-maintenance, labor-saving cultural practices can be employed with the ultimate prospect of no mowing, no fertilizing, no irrigating — a distinct possibility for roadsides, waste and other minimal-maintenance areas. Today, in Korea, most of the native zoysia which predominates over the countryside receives no maintenance whatever. Athletic fields, golf courses, and other high-use areas will require more intensive management. The nitrogen requirement ranges from ½ to 2 pounds nitrogen per year.

The use of treated seed opens new horizons for zoysiagrass. Zoysia seed can be planted efficiently with a hydroseeder, conventional drop, and rotary broadcast seeders. A complete cover in less than a year is usually assured when scarified and treated with light. Companion seeding of cool-season turfgrasses such as Kentucky bluegrass, perennial ryegrass, and tall fescue insures almost immediate use as well as erosion control during the first winter and spring. It is easy to convert to a complete zoysiagrass stand with appropriate cultural practices or a dormant spraying with glyphosate. The prospect of new cultivars promises more versatility on all areas from roadsides to fine lawns.

The climate and soil for seed production in the United States is excellent, but better seed harvesting techniques remain to be developed. When this is a reality, then zoysiagrass, a much-needed species for the transition zone, will undoubtedly be far more widely used.

Figure 2 summarizes techniques for treating and establishing zoysiagrass from seed.

FIGURE 2

SEED TREATMENT	SEED ESTABLISHMENT
KOH 30%	¾ to 1 lb./1000 sq. ft.
Duration 25 min.	Broadcast or Hydroseed
Light 36-48 hrs.	Lightly rake and/or roll
Presoak 24 hrs.	Siduron 8 lbs. a.i./acre
80-90% germination in 7 days	Irrigate as needed
	Post treatment 2,4-D/ dicamba if needed

MAINTENANCE Aids

A TIP FROM

JAMES McNALLY, Golf Course Superintendent
Manasquan River Golf Club, Brielle, New Jersey

MECHANICAL SAND rakes have proven to be adaptable to multi-purpose use. Superintendent McNally made a one-step operation of overseeding weak areas by attaching the seeder box as shown. This equipment is convenient for all small overseeding tasks and because of the low-pressure feature of the tires, it can be safely used for overseeding putting greens.