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TURF MANAGEMENT

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BEHAVIOR OF ZOYSIA JAPONICA MEYER IN COOL-SEASON TURF

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THERE HAS BEEN increased interest by homeowners, golf course superintendents and others the last few years concerning the use of *Zoysia* for turf purposes. In response to numerous requests regarding the use of this grass for turf under New England conditions, a number of experiments have been under study at the Rhode Island Agricultural Experiment Station since 1936.

Zoysia japonica, Japanese or Korean lawngrass, was introduced into the United States in 1906 by Frank N. Meyer, plant explorer for the United States Department of Agriculture, who collected the seed in Korea and designated it as *Zoysia pungens*. Later the name was changed to *Osterdamia pungens* and still later to *Zoysia japonica* (see footnotes 1 and 3). The second introduction was made in 1930 from Kokai, Korea, by W. J. Morse and P. H. Dorsett who found it in an area where

winter temperatures reached -40°F . and the ground froze to $2\frac{1}{2}$ to 3 feet (see footnote 2). A finer textured species, *Zoysia matrella*, Manila grass was introduced in 1911 from Manila, Philippine Islands by Dr. C. V. Piper, United States Department of Agriculture (see footnote 2).

After over 40 years of careful selection, breeding and experimentation a strain of *Zoysia* has been developed which has more favorable characteristics for turf purposes than the parent plant. The new improved strain numbered Z-52 and designated as Meyer *Zoysia* has a texture quite similar to Kentucky bluegrass, is very drought resistant, thrives during the heat of summer and grows in almost any type soil, requires relatively little maintenance and appears to be fairly resistant to insects and wear (see footnote 1).

In May, 1949, Z-52 *Zoysia* was supplied to the Rhode Island Station by the United States Department of Agriculture in cooperation with the United States Golf Association for trial under different environmental and cultural conditions. It was suggested that sod plugs of the *Zoysia*, if planted into existing turf, might mix

Literature Cited

1. Grau, Fred V., and Alexander M. Radko, Meyer (Z-52) *Zoysia*. *USGA Journal and Turf Management* pp. 30-31. Nov., 1951.
2. Harper, John C., *Zoysia for Turf: Varieties and Adaptations*. Proc. 23rd Annual Penn State Turfgrass Conference pp. 47-50. Feb. 1954.
3. Hitchcock, A. S., *Manual of the Grasses of the United States*. U.S.D.A. Misc. Pub 200, Revised by Agnes Chase 1950

and blend to provide a combination turf that would be composed of a good warm season grass and a good cool season grass which together would represent a superior and very satisfactory year-round turf.

Methods and Materials

To determine lateral spread and compatibility of Meyer Zoysia in pure plantings of basic grasses and in mixtures of basic grasses, sod plugs of Meyer Zoysia two inches in diameter and two inches in depth were planted in the center of the subplots of the various grasses and mixtures, June 1, 1952. The Zoysia plugs were obtained from a nearby plot which was planted with Z-52 stolons in May, 1949, and represented healthy and vigorous Zoysia turf which had been maintained at a height of one inch.

The experimental area consisted of 4000 square feet of turf planted to individual and mixed seedings of basic, permanent lawn grasses. The plots, seeded in August, 1949, were 10 by 20 feet. A split plot design was employed for mowing with one half of each plot cut at three-fourths inch and the other half at one and one-half inches. The plantings and rates of seedings are given in Figure 1 (page 29) at the conclusion of this article. The pH of the area at the time the Zoysia plugs were planted was 6.9.

The turf was mowed twice weekly. An 8-6-4 fertilizer with 30 percent of the nitrogen in a natural organic form was applied at the rate of 15 pounds per 1000 square feet both in the spring and early fall. Supplemental nitrogen in the form of ammonium sulphate at the rate of three pounds per 1000 square feet was applied once during the growing season. A combined broad-leaved weed and crabgrass treatment was made in 1953 by applying 2, 4-D amine and phenyl mercuric acetate (PMAS 10%).

Data on the lateral spread of Zoysia were taken in November of 1953 and in November of 1954. Since the Zoysia did not spread uniformly in all directions, measurements of minimum and maximum lengths and widths of spread were taken together with an estimate of the number

TURF MANAGEMENT

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of square inches covered. From these figures an approximate area of Zoysia spread was determined. Compatibility of Zoysia with the other grasses was determined from observation. Turf scores for 1953 and 1954 of the various sub plots into which the Zoysia plugs had been planted were taken and presented in Table 1. (Page 31).

Results and Discussion

During the first growing season little could be learned concerning the lateral spread and compatibility of the Zoysia. By late fall of 1952 all of the plugs were alive and had taken root, but no lateral spread was noted. The following winter was exceptionally mild with the minimum temperature recorded as only 5°F. No winter kill of the Zoysia occurred.

Observations made early in the growing season of 1953 showed the Zoysia to be living and healthy but still making no apparent lateral growth. As the season progressed, however, it was observed on some plots that the Zoysia was beginning to spread. The winter of 1953-1954 was more severe with the minimum temperature being recorded as -18°F. Snowfall was not heavy, but the plots were covered most of January and February. No winter kill was evident.

During 1954, good lateral spread of Zoysia was evident in some of the plots. The results of measurements taken in November 1953 and 1954 are given in Table 1 (page 31) and shown graphically in Figure 2 (page 30).

Lateral spread of Zoysia was most in the plots of Trinity, Illahee, Creeping Red

and Chewing's fescue where the area in square inches ranged from 180 to 480 in the closely cut turf. Compared to this the spread of the Zoysia in the fescue turf cut at 1½ inches ranged from 48 inches in Illahee to only 8 in Chewing's fescue and even to no spread at all in the Creeping Red fescue.

On the plots of Arlington Creeping bent, Seaside bent and Velvet bent the lateral spread was considerably less, as the area ranged from 4 to 9 square inches on the closely cut turf and from 1 to 8 inches on the 1½ inch cut turf. Some of these grasses appeared to resist the spread of the Zoysia, and in some cases the 2 inch plugs were reduced in size and in some other cases no evidence of Zoysia could be found in 1954. The fact that there was little or no spread of the Zoysia into these grasses and even reduction of Zoysia, could be considered as incompatibility provided by the competition of dense turf.

On the Colonial bent plots mowed at ¾ inch height the spread of Zoysia ranged from 32 to 48 inches, and on the 1½ inch cut plots the spread ranged from 0 to 18 inches.

The amount of spread of Zoysia into Commercial Kentucky bluegrass was 52 square inches and into Merion bluegrass 24 inches at the ¾ inch cut, and on the 1½ inch cut the lateral spread was 15 inches in the Merion and only 6 inches in the Commercial bluegrass.

The Kingston Mixture which is composed of the 3 basic cool season grasses, namely Chewing's fescue, Kentucky bluegrass and Astoria Colonial bent was only invaded to the extent of 21 square inches

on the closely cut turf and there was even a reduction of the 2-inch plugs to only 1 square inch on the 1½ inch height of cut. Similar results were recorded on the mixture of Kentucky bluegrass and Astoria Colonial bent, and also on the Chewing's fescue and Velvet bent mixture. However, it can be noted that there was more invasion of the Zoysia into the two commercial mixtures at both heights of cut. The commercial mixtures did not produce as dense turf as did the Kingston Mixture.

There appeared to be competition afforded to the lateral movement of the Zoysia by dense healthy turf as can be noted by a comparison of the various turf scores with the amount of spread of Zoysia on the various sub plots. This competition, rather than incompatibility, was probably the reason for such little spread of the Zoysia into some of the plots.

Height of cut had a definite effect also on the spread of Zoysia into the various grasses and mixtures. At the ¾ inch height of cut, the lateral spread of Zoysia was, in general, much greater than at 1½ inch height. In all cases the spread of Zoysia was greater in the closely cut turf.

Under the conditions of this experiment and on the basis of these observations and measurements, Zoysia did not appear to demonstrate good compatibility with the cool season grasses. Where the Zoysia spread was the greatest, it spread by forcing its way into the basic grass area and the intermingling of the two was only slight. It therefore does not appear that the method of planting Zoysia sod plugs 2-inches in diameter into established turf two years old is a satisfactory one to produce a compatible mixed Zoysia and cool season turf. From observations taken throughout the course of this experiment, it was indicated that the combination of warm and cool season grasses will involve much more work in management and culture to provide an even balance of the two. Uniform intermingling, mixing and compatibility is needed to

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prevent patchiness of the turf, which would be especially noticeable in the cool seasons of the year when the *Zoysia* is off color.

Summary and Conclusions

An experiment to study the lateral growth and compatibility of *Zoysia japonica* Meyer in established turf of basic grasses and mixtures maintained at two heights of cut was in progress at the Rhode Island Agricultural Experiment Station during the seasons of 1952, 1953 and 1954.

Sod plugs of Meyer *Zoysia* two inches in diameter were planted in various plots of 2-year old turf of the basic grasses and mixtures June 1, 1952 to observe their lateral spread and compatibility.

Measurements taken in November of 1953 and again in November of 1954 indicated that lateral spread of *Zoysia* was greatest in the red fescues such as Chewing's Illahee, Trinity and Creeping Red fescue, in Commercial bluegrass and in Merion bluegrass and the Colonial bent grasses, whereas lateral spread was least in Arlington Creeping bent, Seaside Creeping bent and in Velvet bent.

The lateral spread of *Zoysia* was inhibited, in general, by dense turf.

Lateral spread was also greater in turf mowed at $\frac{3}{4}$ inch than at the $1\frac{1}{2}$ inch height of cut.

Meyer *Zoysia* appears to be winter hardy in southern New England, but whether it is sufficiently compatible with the basic turf grasses under the cool conditions of the Northeast could not be entirely determined from the results of this experiment to date. Further observation and work need to be done to determine this and to determine the best management practices to blend *Zoysia* with the basic grasses when planted into existing turf.

Under the conditions of this experiment the planting of plugs of *Zoysia* two inches in diameter into the existing turf appeared to be a questionable method. If sod plugs of *Zoysia* should be planted into existing turf the turf should be kept closely mowed to help encourage lateral growth of the *Zoysia*.

COMING EVENTS

1955

June 7:

Joint Meeting of Tidewater Turfgrass Association and Mid-Atlantic Association, GCS, Country Club of Virginia, Richmond, Va.

June 20:

Regional Field Day, Texas Turfgrass Association, Lubbock, Texas.

August 9-11:

Third University of Florida Turf Conference, Gainesville, Fla. Dr. Gene C. Nutter.

August 10:

24th Annual Rhode Island Field Day, University of Rhode Island, Kingston, R. I. Dr. J. A. DeFrance.

August 15-19:

American Society of Agronomy Meetings, Davis, Cal. L. G. Monthey.

August 20:

Regional Field Day, Texas Turfgrass Association, San Antonio, Texas.

September 7-8:

Penn State Field Days, Pennsylvania State University, State College, Pa. Prof. H. B. Musser.

September 23-24:

Edmonton Turfgrass Conference, University of Alberta, Edmonton, Alberta, Canada. Prof. R. H. Knowles.

September 27-28:

Northwest Turfgrass Conference, Pullman, Wash. Prof. A. G. Law.

September 30-October 1:

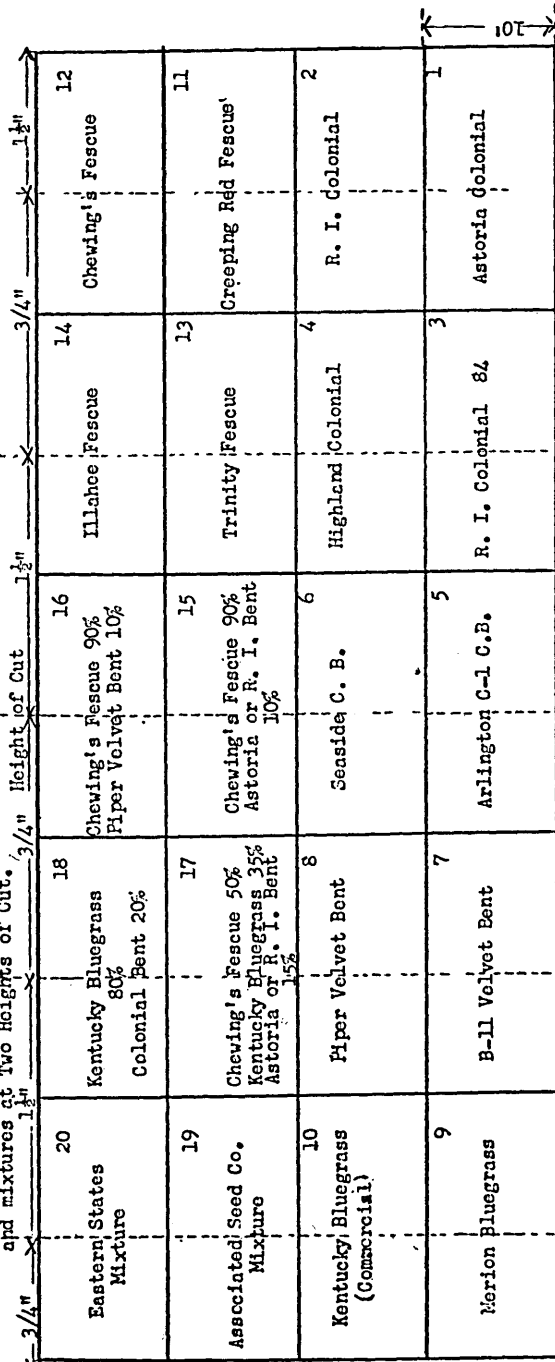
Utah Turfgrass Conference, Utah Copper Golf Course, Magna, Utah. J. W. Richardson.

October 3-4:

Rocky Mountain Turfgrass Conference, Colorado A&M College, Fort Collins, Colo. Prof. George A. Beach.

Contribution No. 855 of the Rhode Island Agricultural Experiment Station. Presented at the Annual Meeting, Northeastern Section of the American Society for Horticultural Science, Harvard University, Cambridge, Massachusetts, January 29, 1955, under the title "The Lateral Spread and Compatibility of *Zoysia japonica* Meyer in Established Turf and Basic Grasses and Mixtures at Two Heights of Cut."

Figure 1. Plot plan for the Study of the Lateral Spread and Compatibility of Meyer Zoysia in Turf of the Basic grasses and mixtures at Two Heights of Cut, $3/4"$ and $1\frac{1}{2}"$



Seeding Rates Per 1,000 sq. ft.
 Colonial Bents.....2 lbs.
 Seaside.....1 1/2 "
 Velvet Bents.....1 "
 Bluegrasses.....3 "
 Fescues.....5 "
 Mixtures.....3 "

Detail Plan of Zoysia Planting

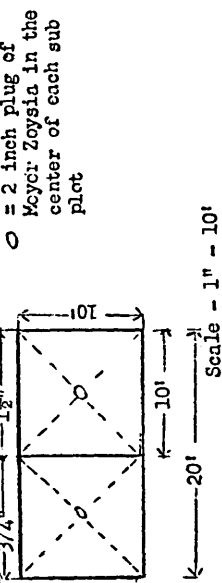


Figure 2 Lateral Spread of Zoysia in Established Turf at Two Heights of Cut - Rhode Island Agricultural Experiment Station, 1954.

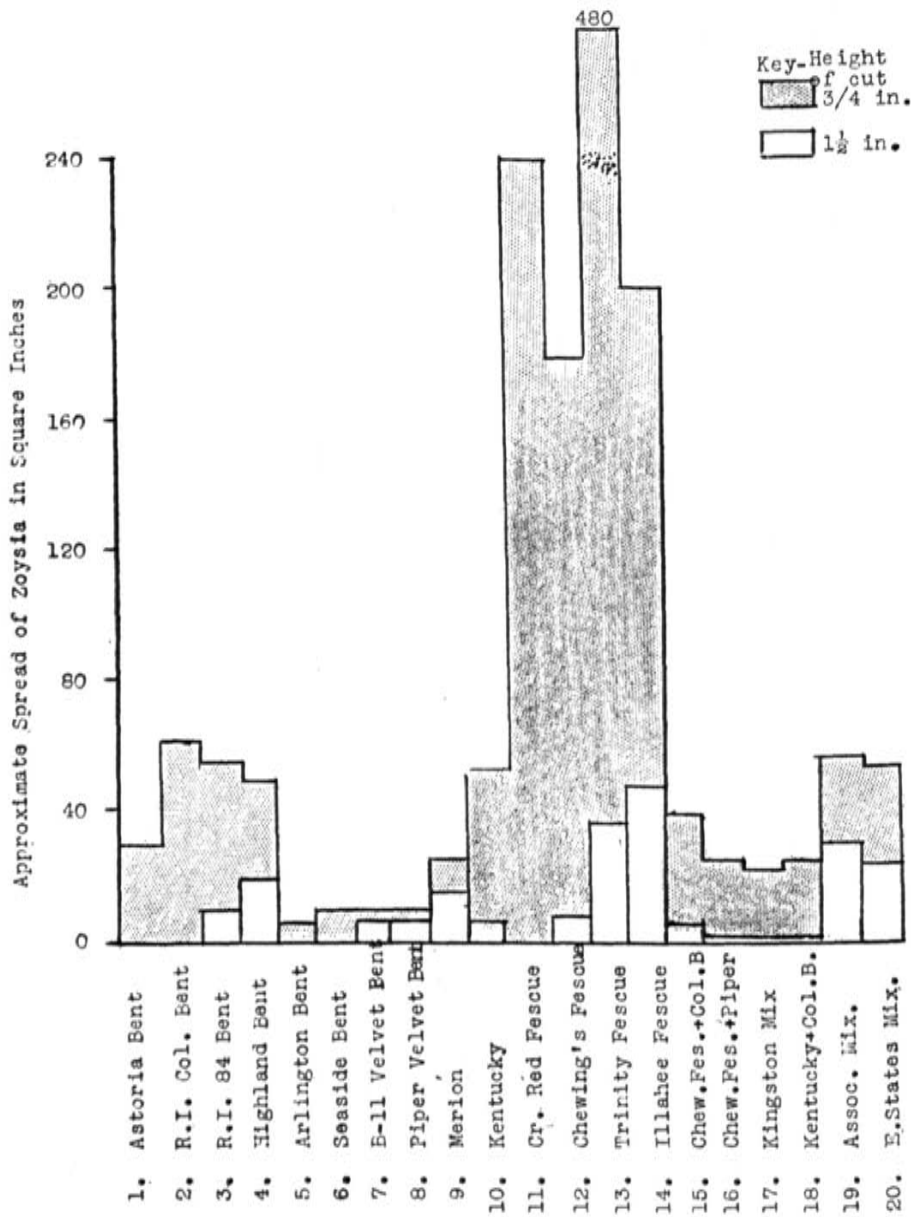


Table 1. The Lateral Spread of Meyer Zoysia into Individual and Mixed Lawngrass Plantings Mowed at Two Heights of Cut During 1953 and 1954 at the Rhode Island Agricultural Experiment Station, Kingston, Rhode Island.

Grass	Height of Cut*	Zoysia Area in Square Inches**		Turfa Score	
		1953	1954	1953	1954
1. Astoria Colonial Bent	L	27	32	6	6
	H	6	0	5	5
2. R. I. Colonial Bent	L	33	60	3	4
	H	9	0	4	3
3. R. I. 84 Colonial Bent	L	16	54	6	6
	H	6	10	6	6
4. Highland Colonial Bent	L	15	48	1	5
	H	6	18	4	3
5. Arlington Creeping Bent	L	1	4	7	8
	H	1	1	7	7
6. Seaside Creeping Bent	L	4	9	6	7
	H	1	1	6	7
7. B-11 Velvet Bent	L	9	9	3	3
	H	6	8	3	3
8. Piper Velvet Bent	L	9	9	4	4
	H	8	8	4	3
9. Merion Bluegrass	L	6	24	8	9
	H	4	15	8	8
10. Kentucky Bluegrass	L	6	52	4	5
	H	1	6	6	4
11. Creeping Red fescue	L	15	240	4	4
	H	4	0	3	3
12. Chewing's fescue	L	18	180	5	5
	H	6	8	5	5
13. Trinity fescue	L	16	480	4	6
	H	12	36	6	5
14. Illahee fescue	L	36	200	5	5
	H	12	48	6	4
15. Chewing's fescue plus Colonial Bent	L	16	39	6	7
	H	6	4	6	7
16. Chewing's fescue plus Velvet Bent	L	16	24	5	5
	H	6	1	5	4
17. Kingston Mixture	L	24	21	7	7
	H	4	1	7	7
18. Kentucky 80% plus Colonial Bent 20%	L	20	24	6	5
	H	4	1	6	5
19. Associated Mixture	L	10	56	7	6
	H	6	30	7	6
20. Eastern States Mix	L	24	54	3	7
	H	9	24	4	3

Note: Two-inch plugs of Zoysia were planted in the center of each sub-plot on June 30, 1952.

^a Turf score rating ranges from 1 to 10 with 1 as poor and 10 as excellent and refers only to the turf plots of the individual grasses or mixtures into which the 2-inch plugs of Zoysia were planted.

* L = $\frac{3}{4}$ inch Height of Cut, H = $1\frac{1}{2}$ inches Height of Cut.

** Area is approximate since Zoysia does not spread uniformly in all directions.