The most interesting explanation of why the addition of organic matter in general, and kelp products in particular, affect the population levels of the nematodes is suggested in recent reports (1, 2, 5). These reports all tend to link control of nematodes, when organic matter is applied, to the level of phenolic compounds in the soil. These phenols come from the decomposition of the organic matter and have been proven to be detrimental to nematodes (2, 3, 6). As stated by Alam *et al.*, 1979, "It is suggested that organic amendments induce a certain degree of resistance to nematodes by an enhancement of phenols in the roots." (1)

In most articles reviewed it is noted that although addition of organic material does suppress nematode populations, it does not do so to the extent of reduction provided by chemical nematicides. However, there are only a few nematicidal chemicals available for turfgrass and these are not always effective, therefore alternatives must be sought. Another reason that the use of organic matter might well be considered as an integrated pest control method is based on the ecological point of view. Benefits to be derived from such usage are: 1) nonpollution of the environment, 2) increased vigor of the host plant possibly due to increased phenolic content, and 3) decreased *risk of nematode* resistance to chemical nematicides.

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APPRAISAL OF ST. AUGUSTINEGRASSES FOR SOUTH FLORIDA[1]

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Abstract. **A number of St. Augustinegrass varieties are available for use in home lawns and other turf areas. Hundreds of millions of dollars are spent each year in Florida to maintain St. Augustinegrass, so it is important to select the best variety for a given situation. Varieties of St. Augustinegrass differ considerably in beauty and maintenance requirements. A worldwide germplasm collection of 143 St. Augustinegrasses was compared during 1.5 years in replicated field plots. Characteristics for systematic comparison included: coverage, deepness of color, internode length, and incidence of gray leafspot disease. Other characteristics were determined from long-term (up to 5 years) evaluation plots and from published literature. Based on over 3500 comparative observations, some presently available varieties such as 'Floratam' and 'Floratine' were among the most acceptable genotypes. One recent release, 'Seville', was a superior dwarf St. Augustinegrass, and would make a fine quality lawn, but could be prone to injury by the southern chinch bug. In addition, longer term studies would be required to evaluate maintenance requirements and the possibility of accumulating undecomposed stolons. Older pasture varieties, i.e., 'Florida Common' and 'Roselawn', that are still being sold and distributed were unacceptable from the standpoints of coverage and esthetics. Most other genotypes, including collections from scattered locations in Florida and other southeastern states, were significantly lower in quality characteristics than 'Floratam' or 'Floratine.'**

St. Augustinegrass (*Stenotaphrum secundatum* (Walt.) Kuntze) is genetically variable for a number of esthetic and adaptive traits. Because of the widespread distribution of this species in lawns in south Florida, we will describe St. Augustinegrass varieties in terms of their value for turf.

The earliest work on this subject consisted primarily of esthetic comparisons based on obvious morphological and color differences. Shorter leaves and internodes were related to the improved density of 'Bitterblue', in contrast to the older variety 'Roselawn', which tended to be coarser (13) and yellow-green. Leaf color was emphasized in other variety comparisons during that era. An attempt to summarize several esthetic attributes was demonstrated by Nutter and Allen (6). Their "relative weighted value" was a composite of several esthetic components. Narrower leaves were considered more desirable, along with darker blue-green color and shorter height. Adaptive traits were first emphasized in a variety comparison by Horn *et al.* (5). In the release of the variety 'Floratam' a superiority in SAD virus and southern chinch bug resistance was demonstrated. These and other components of turf performance should continue to be recognized along with the traditional esthetic considerations.

Although previous workers have used a number of characteristics for appraising St. Augustinegrass varieties, there does not exist a method for making highly objective distinctions. Problems include the inadequacies of variety descriptions (2) and the need to understand apparent contradictions among different testing locations or among conflicting attributes. There has been little attention in the published literature on St. Augustinegrass to damaging thresholds of pests or to the correlation of resistance data with economic damage under field conditions. In a broader sense there appears no documented economic *rationale* for recommending one variety over another.

[1]Florida Agricultural Experiment Station Journal Series No. 2744. Reference to any variety does not constitute an endorsement. These comparisons apply strictly to the environmental and management conditions as described. We thank the cooperation and assistance of Dr. R. A. Atilano, Ms. B. J. Center, Mr. J. C. Kaczor, Ms. E. T. Klatt, and Dr. W. C. Mixson, who made this study possible.

In spite of these reservations we propose a number of choices and decisions on "acceptability" that in our judgment are clearcut, at least for irrigated turf areas in south Florida. In other details of choice, and even the major decision on whether to use a high maintenance or low maintenance sod, much of the final burden of selection will remain with the turf consumer.

Materials and Methods

Stolon segments were collected from 143 genotypes of St. Augustinegrass. Genotypes represented plant introductions from Africa, random Gulf Coast collections made by the senior author, and advanced selections, hybrids, and mutants from several breeding programs, primarily Texas A&M University, O. M. Scotts & Sons, and the University of Florida. One grass, Scotts-6-72-516, has since been distributed under the variety name 'Seville'. The grasses were planted in 2-gallon plastic pots and maintained for up to 2.5 years prior to increase for field planting. Grasses were increased in a blocked arrangement prior to field planting, to ensure that effects during pre-planting propagation would be entirely accounted for in the final statistical analyses, rather than being absorbed as spurious genotype effects. Field plots 2 x 3 m were each planted (from 16 to 20 April 1979) with a genotype represented in 5 or 6 peat pots. The experimental area consisted of Hallandale fine sand, a siliceous, hyperthermic, Typic Psammaquent, located at the Agricultural Research Center-Fort Lauderdale, FL (Fig. 1). An augmented experimental design was used with 26 genotypes —including major varieties and promising experimentals— replicated four times. Another 117 genotypes for which little preliminary information was available were replicated only two times.

Plots were separated during the first year of growth by alleyways sprayed with a nonselective herbicide. Plots were mowed weekly during the first year at a height of 5 to 7 cm, and biweekly thereafter. Plots were fertilized according to University of Florida recommendations to provide 32, 4, and 13 g/m^2/year of N (50% water insoluble), P, and K, respectively (12). Irrigation was provided nightly to field saturation. One application of asulam was made early in the test period to control grassy weeds, but no insecticides or fungicides were used. These management practices were somewhat more intensive than would be appropriate for established turf, but were somewhat less intensive than would be used during sod production and establishment.

Measurements were made of internode length and color, and maximum stolon length per plot (1 month), gray leafspot incidence (2 months), blueness (7 months), percent ground coverage (5, 7, and 12 months), and overall quality (12, 16, and 18 months). Analysis of variance was performed separately for the two- and four-replicated sets, and mean separation performed on the four-replicated set by the L.S.D. test based on a prior significant F-value ($P<0.05$).

Additional larger plantings of certain genotypes (Flora-

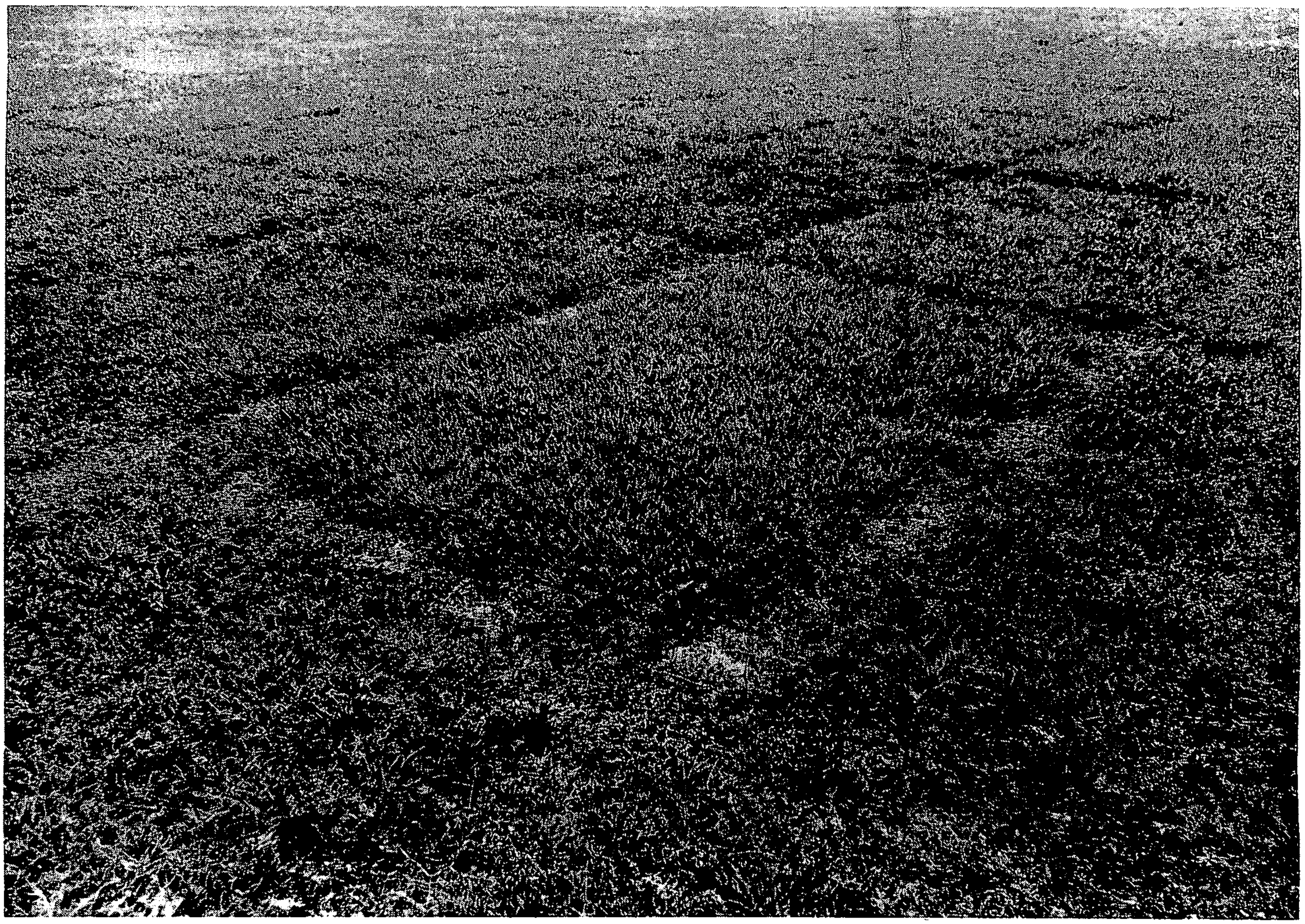

Fig. 1. St. Augustinegrass evaluation plots at ARC-Fort Lauderdale. A worldwide collection was maintained in replicates and evaluated for several performance and esthetic characteristics. Floratam Mutant #6, in the center, was developed by J. B. Powell and R. W. Toler. This experimental strain produced the most rapid coverage of any of the blue-green genotypes, and also had shorter internodes than Floratam.

tam, Floratine, FA-243, 'Bitterblue', 'Scotts 1081, and FL-2002a) were evaluated at ARC-Fort Lauderdale and at a sodded lawn in Deerfield Beach, FL (Fig. 2). Published information on chinch bug resistance (7, 9, 10, 11) was also consulted in comparing St. Augustinegrasses.

Results and Discussion

Highly significant differences were observed for all characteristics evaluated. Examples of the data for cultivars and some outstanding selections are presented in Table 1. The 16-month overall quality evaluation was highly correlated (r = 0.55 to 0.72) with earlier coverage evaluations and is considered as another coverage rating. The most dramatic visible differences were observed in the rate of coverage of certain genotypes. Very rapid coverage was attained in certain dwarf St. Augustinegrasses, up to 64% average coverage after 5 months in FL-2092, a mutant derivative of FA-243 (3). The rate of coverage of some non-dwarf types, such as Floratam Mutant #6 was also rapid. This genotype was produced by gamma irradiation from Floratam (11) by J. B. Powell (USDA-SEA, Beltsville, MD). The coverage of Floratam after 12 months was 60%, compared to 84% for Floratam Mutant #6. In our opinion both would be acceptable. The older pasture variety Roselawn (1) was unacceptable in coverage ability. Rapid coverage by sprigged material is desirable from a sod production standpoint, and may minimize future weed problems. For example, FA-243 maintained a nearly weed free sod for up to 5.0 years in some plots at ARC-Fort Lauderdale. Rapid coverage could, unfortunately, also lead to excessively spongy turf, that is, an excessively deep buildup of undecomposed stolons.

In terms of long-term retention of cover, only 20 out of 142 genotypes equalled or exceeded Floratam coverage in the 16-month rating. Only one grass, Seville, had a statistically higher (P = 0.05) coverage than Floratam after 16 months.

The only St. Augustinegrasses that attained an intensive blue color were genotypes of the Bitterblue/Floratine complex, and Floratam and its mutant derivatives. Blueness is desirable in a turfgrass because it masks out discontinuities in fertility level, especially nitrogen deficiency. Other genotypes such as Scotts 1081 and Seville which lacked the "blueness" characteristic had leaves that were nevertheless relatively deep and rich in color intensity, and might provide an adequately uniform appearing lawn. Some other dwarf St. Augustinegrasses, such as FA-243 and especially FL-2002a looked very attractive in smaller plots, but showed up variations in fertility level in larger plots.

From the standpoint of diseases likely to affect St. Augustinegrass in south Florida, none of the "acceptable" grasses have serious limitations. Even gray leafspot disease, which greatly affects some of the blue-green genotypes (4) should not be an economic problem in established turf properly maintained. Other St. Augustinegrasses that rated "unacceptable" may have unknown disease limitations that resulted in their very poor coverage ability. The close

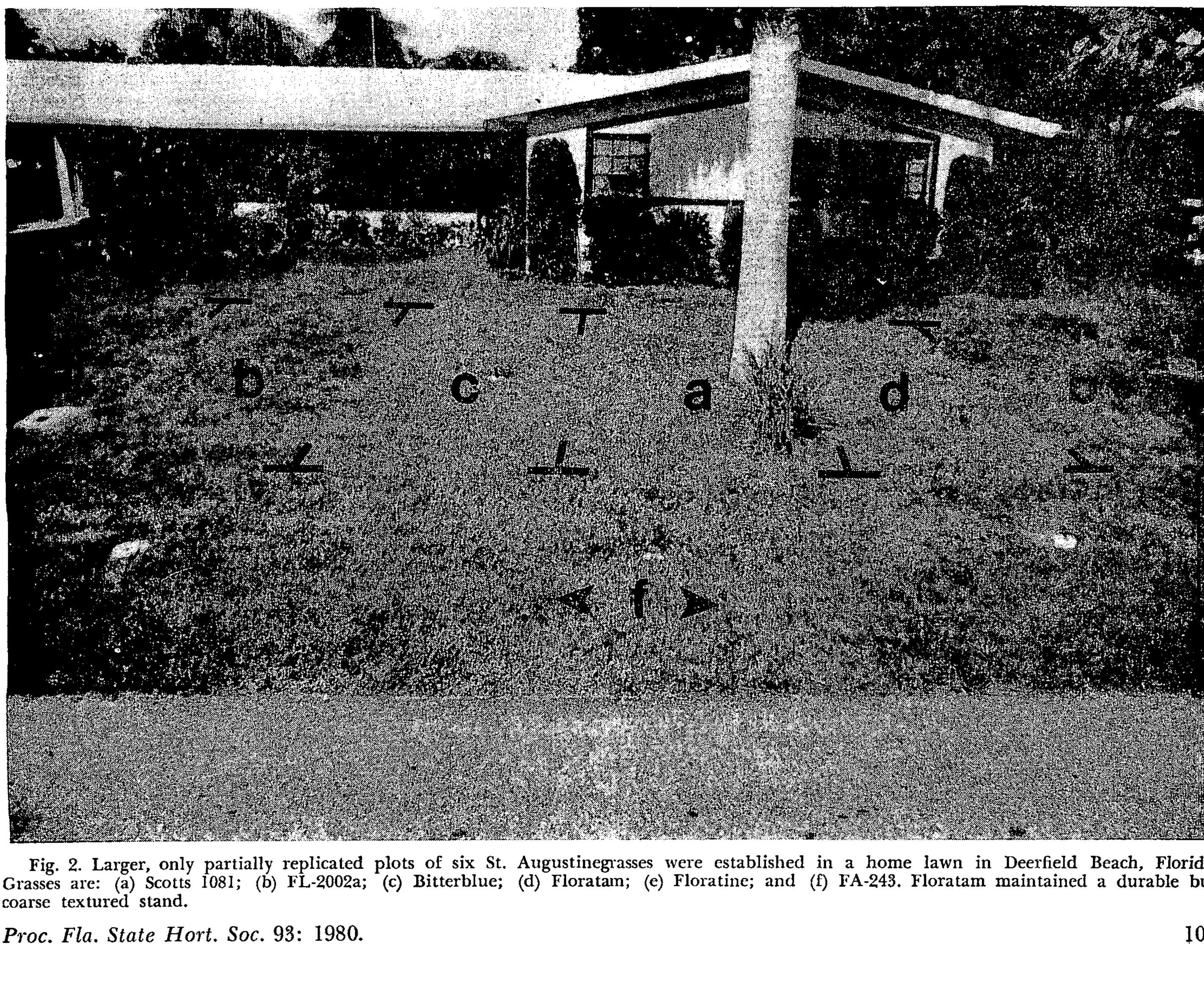

Fig. 2. Larger, only partially replicated plots of six St. Augustinegrasses were established in a home lawn in Deerfield Beach, Florida. Grasses are: (a) Scotts 1081; (b) FL-2002a; (c) Bitterblue; (d) Floratam; (e) Floratine; and (f) FA-243. Floratam maintained a durable but coarse textured stand.

Table 1. Comparison of St. Augustinegrasses for south Florida, summary of coverage, esthetic quality, and other features. Genotypes are arranged *in three groups* for ease of comprehension. Means of four replicationsa re presented, except as indicated.

Criterion:	Coverage	Esthetic quality		Other features	
Variety	12 months (%)	Blueness[z]	Internode length (cm)	Gray leafspot[y]	Chinchbug relation[x]
(Dwarf genotypes, arranged in order of estimated overall quality. Liable to develop sponginess and sod webworm problems; require heavy fertilization)					
Seville	86	2.0	4.5	5.3	SUS (9)
Scotts-6-72-99	77	1.8	4.1	4.5	—
FL-1933-8 (2 replicates)	90	2.0	4.2	2.8	SUS (Unpub)
Scotts 1081	79	1.3	3.9	2.9	SUS (10)
FA-243	68	1.5	4.1	3.5	RES (7)
FL-2002a	68	1.3	4.3	3.8	SUS (9)
(Coarse-textured blue-green genotypes, arranged in order of estimated quality)					
Floratam Mutant #6 (2 reps)	84	3.0	5.3	3.0	RES (11)
FA-108 (2 reps)	75	3.0	5.9	5.8	RES (10)
Floratam	60	2.9	6.3	5.0	RES (7,9-11)
Floratine	69	2.9	4.7	7.8	TOL (10)
Bitterblue	55	3.0	3.7	8.0	SUS (10)
(Coarse pasture types, unacceptable)					
Roselawn	29	1.5	8.1	1.5	SUS (10)
Florida Common	53	1.3	7.2	2.8	SUS (7,9-11)
L.S.D. (0.05)[w]	22	0.7	1.0	2.6	—

[z]Blueness estimated visually with 3 = very blue-green; 1 = essentially green.
[y]Gray leafspot disease rating estimated visually, 8 = devastated, 1 = no spots.
[x]RES = resistant; TOL = tolerant; SUS = susceptible; numbered references cited in literature.
[w]Least Significant Difference values are based on comparisons of means of four replicates.

height of cut may have been a factor favoring the early rapid coverage of some dwarf genotypes, but was clearly not a determining factor, as some very coarse genotypes did very well.

The only commercially available St. Augustinegrass that is resistant to the southern chinch bug is Floratam. Some similar types, such as the Floratam mutants and sibling FA-108 are also resistant (10, 11). Southern chinch bug problems might be expected in any of the varieties or experimentals that are not resistant (Table 1). Although FA-243 showed a chinch bug resistance in laboratory experiments (7), this genotype was killed in patches by chinch bugs in plots at Deerfield Beach. Thus, laboratory resistance does not assure field resistance. Under conditions of adequate irrigation, and the availability of chemical control of chinch bugs, genetic susceptibility should not be a reason to preclude the use of a variety that is superior in other respects. Anyone using a susceptible variety, however, should be forewarned that effective chemical controls cannot always be depended upon, for example, chinch bugs have been shown to develop resistance to most classes of insecticides (8).

In conclusion, a small number of St. Augustinegrasses had numerically equal or greater coverage than Floratam, under the conditions and duration (1.5 years) of this performance trial. Most rapid coverage genotypes were dwarf genotypes of questionable value as turf. As a group these tended to become spongy, to show fertility deficiencies in larger plots, and occasionally to become infested with sod webworm. Furthermore, few of the rapid coverage St. Augustinegrasses also had the desirable blue-green color characteristic that would conform to generally expressed esthetic preferences. Two promising dwarf types that retained good long-term coverage included the new release Seville. This variety and the experimental selection Scotts-6-72-99 appear to be the best covering, deep-colored dwarf St. Augustinegrasses in the collection, although only the test of time will tell whether the inherent chinch bug susceptibility of Seville will be a limiting factor.

For consumers interested in a dependable, long-term lawn, it appears that there is presently very little in the germplasm collection that is numerically better in coverage or color than Floratam. The improved coverage of Floratam Mutant #6 and, to a lesser degree, FA-108, are of great interest for further study. Certain wide hybridizations, such as FL-1933-8 (female FL-1933 from Texas and male PI-365032 from Africa) combine some very desirable attributes of good coverage and adaptation.

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