RESPONSE OF WOODY LANDSCAPE PLANTS TO BERMUDAGRASS COMPETITION AND FERTILITY[1]

by Carl E. Whitcomb

Abstract. *Four species of woody plants were grown at 3 fertilizer levels in an established bermudagrass sod with 3 sizes of areas free of bermudagrass around the plants. By the end of the second growing season, all woody species were much larger when bermudagrass was kept away from the base of the plants. There was no difference in plant response between the sizes of the 2 cleared areas except the visual grade of holly and privet. Keeping a cleared area free of bermudagrass around newly planted trees and shrubs greatly increases growth.*

The landscape environment is not well understood (4, 5, 6). In contrast with classical agriculture where large areas of a single crop are grown, the man managed landscape is a consortium of woody plants, generally unpruned or lightly pruned, growing in a grass sod that is frequently and severely pruned. In the southern states the warm season grasses are best characterized as being very aggressive with strong stolon development in full sun despite the severe pruning. Bermudagrass, *Cynodon dactylon,* centipedegrass, *Eremochloa ophiuroides,* St. Augustine grass, *Stenotaphrum secundatum,* and Bahiagrass, *Paspalum notatum,* were studied by Dean, Joiner, and Whitcomb (3) with regard to their effect on pyracantha, *Pyracantha coccinea,* Hetzi Chinese juniper, *Juniperus chinensis* 'Hetzi', green pittosporum, *Pittosporum tobira,* and lantana, *Lantana camara.* They found that bermudagrass had by far the greatest suppressing effect of the woody plants with centipede and bahiagrass intermediate and St. Augustine having the least effect.

Harris (2) observed a restriction in stem diameter and height of *Magnolia grandiflora* and *Zelkova serrata* when grown in an established turf of fall fescue, *Festuca arundinacea.* Whitcomb (7) noted that silver maple, *Acer saccharinum,* roots were not present in the upper ½ inch of soil following seeding of Kentucky bluegrass, *Poa pratensis.* He could not explain why the tree roots grew at the very surface of the soil where the bluegrass was absent but were eliminated when the grass was present. Richardson (1) reported that perennial ryegrass, *Lolium perenne,* depressed root growth rate, shortened the period of actual growth, reduced the density of root hairs and restricted both rooting depth and lateral spread of roots of sycamore maple, *Acer pseudoplatanus.* He concluded that competition of the ryegrass for nitrogen was a major factor in the restricted growth of the maple trees. Messenger (8) reviewed the literature in this area and concluded that the shallow, lateral roots of trees are forced to compete for essential substances, especially nitrogen and that all parts of the trees may be adversely affected.

Bermudagrass is one of the most severe competitors of all lawn grasses (3). Since bermudagrass is the dominant lawn grass in the southern states and most new landscape plantings are placed into an established sod, studies of this nature should aid in advising individuals what, if anything, can be done to aid the woody plant.

Methods

A dense sod of U-3 bermudagrass was established on a moderately fertile clay loam soil. Woody plants were planted in the sod using 3 clearing and 3 fertility treatments in a 3 × 3 factorial set of treatment combinations with 5 replications. Cleared areas were maintained by using Roundup (glyphosate) at 4 tbsp./gal. of water as a spray during the growing season.

Clearing treatments:

1. A 60 inch square around the plant was kept free of grasses and weeds.
2. A 30 inch square around the plant was kept free of grasses and weeds.
3. No clearing, bermudagrass was allowing to grow up to the stem of the plant following planting.

Fertility treatments:

1. Base fertility only, approximately 1 lb. N/1000 sq. ft. was applied twice during

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growing season broadcast over entire area.
2. An additional two lbs. N/1000 sq. ft. applied spring and fall to an area 5′ × 5′ square around the plants.
3. An additional four lbs. N/1000 sq. ft. applied spring and fall to an area 5′ × 5′ square around the plants.

During October, 1976, uniform one gallon container stock of the following species were planted: *Ilex cornuta,* 'Burford Nana', dwarf Burford holly; *Juniperus chinensis,* 'Hetzi', Hetzi Chinese juniper and *Pinus thunbergi,* Japanese black pine. *Ligustrum vicaryi,* golden vicary privet was planted during June, 1977.

Results

Only slight differences in plant response to reducing the bermudagrass competition could be seen during the first spring and summer. However, by the end of the 1977 growing season the rapidly growing vicary privet had 100% increase in the number of branches per plant with either clearing area as compared to no clearing (Fig. 1). Plants were only slightly larger where extra fertilizer had been applied and all plants were about the same height.

On July 19, 1978, dwarf Burford holly were given a visual grade rating from 1 (poorest) to 10 (best). The high fertilizer treatment and the 60 inch square area free of bermudagrass around each plant averaged 7.6 whereas the high fertilizer and 30 inch square averaged 6.6. Plants with no clearing of bermudagrass averaged 1.3 regardless of the fertilizer treatment.

Japanese black pine had 11% greater stem caliper, 7% greater height and 31% greater branch number where bermudagrass was kept away from the young trees compared to no clearing (Fig. 2). Increasing fertilizer from the maintenance level for the bermudagrass to the high rate increased height 10%, caliper 11%, but had no effect on number of branches.

Pfitzer junipers were 33% larger with 38% more branches where either clearing was main-

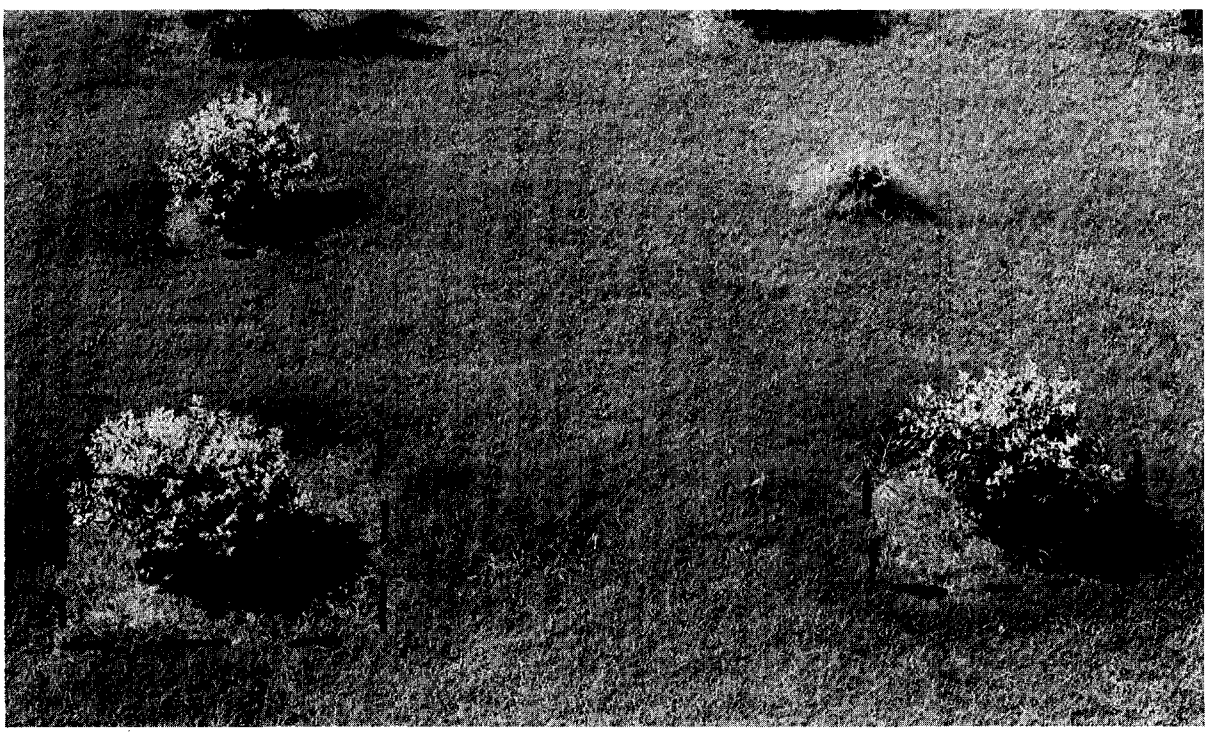

Fig. 1. Size of ligustrum with additional fertilizer and 60″ clearing (lower left), additional fertilizer and 30″ clearing (lower right), no additional fertilizer and 30″ clearing (upper left) and no additional fertilizer and no clearing (upper right) as of August, 1978.

Fig. 2. Growth of Japanese Black Pine with additional fertilizer and 60" clearing (left) and with no additional fertilizer and no clearing (right).

tained. Fertilizer only slightly increased juniper growth, with or without the bermudagrass competition.

All four species responded to removal of bermudagrass from around the plants (Table 1). These results are similar to those reported by Dean, et al. (3). Applying additional fertilizer around the plants did not increase the ability of the tree or shrub to compete with the bermudagrass where no clearing was provided. This is in contrast to work by Harris (2) who found that nitrogen fertilization was effective in increasing growth of magnolia trees which had fescue sod growing to their trunks. Richardson (1) also felt that competition for nitrogen was a major factor in the detrimental effect of ryegrass on sycamore maple. Whitcomb (7) speculated that allelopathy (the production of a chemical compound by one plant which is toxic to another plant) may be involved in some tree-turf relationships. Since addi-

Table 1. Effects of maintaining a bermudagrass free area around landscape plants on plant growth and visual quality.

	Bermudagrass-Plant Relationship		
	60" sq. clearing	*30" sq. clearing*	*no clearing*
Japanese black pine 1979 growth flush (inches)	19.2a	18.0a	9.4b
Overall plant height (inches)	64a	60a	51b
Visual grade[z]	7.4a	7.3a	4.4b
Hetzi chinese juniper growth spread (inches)	72.5a	70.2a	57.1b
Visual grade[z]	9.5a	8.8a	4.5b
Golden vicary privet Visual grade	8.1a	5.5b	2.2c
Dwarf Burford holly Visual grade	6.5a	3.3b	1.3c

[z]Based on a 1 (poorest) to 10 (best) rating of overall landscape appearance. Values are the averages of ratings by 3 individuals and 5 replications.

tional fertilizer did not assist the woody plants when the bermudagrass was present and during the study moisture stress was never severe, allelopathy may be involved. The subtle but certain restriction of growth of woody plants by bermudagrass, even though the grass is severely and frequently pruned, encourages such a hypothesis. There appears to be little advantage to 60" over 30" cleared areas except with the privet and holly. This was probably due to the more drought sensitive nature of the holly and extremely vigorous growth of the privet. However, as the trees and shrubs grow larger and roots progress laterally, the larger cleared areas may prove beneficial.

Keeping a cleared area free of bermudagrass at least 30" square appears to be one additional way to aid the establishment and growth of newly planted trees and shrubs. Under stress conditions, removal of competition may make the difference between survival and death of some plants.

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PROGRESS REPORT: COUNCIL OF TREE AND LANDSCAPE APPRAISERS: 1975-1980[1]

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The objectives of CTLA are: 1) to periodically revise the *Guide for establishing values of trees and other plants,* 2) to correct the indifferent attitude toward trees that prevails in many areas, 3) to portray and convince "people" that trees have value and that the value can be measured or appraised by competent horticulture appraisers. Reference to "people" includes horticultural trade organizations, homeowners, industrial developers, insurance companies, Internal Revenue Service, legal associations, property management companies, public officials, public property supervisors, realtors, and utility organizations, 4) to improve horticultural appraisal procedures and practices through sponsored workshops and other means, 5) to function a liaison between the supporting organizations and regulatory agencies, and others, in areas of involvement relating values of trees and other plants, and 6) to prepare audio/visual material for public information, radio and television.

The accomplishments of CTLA can be summarized in three categories: *Guide* revisions, public relations activities and other activities. Two revisions of the shade tree evaluation guide have been completed: *A guide to the professional evaluation of landscape trees, specimen shrubs, and evergreens* in 1975, and *Guide for*

[1]Presented at the annual conference of the International Society of Arboriculture in Hartford, Connecticut in August 1980.