

Effect of Cogongrass (*Imperata cylindrica*) Extracts on Germination and Seedling Growth of Selected Grass and Broadleaf Species¹

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Abstract: The effects of cogongrass foliage and root residue extracts on germination and radicle and coleoptile growth of barnyardgrass, browntop millet, bermudagrass, hemp sesbania, Italian ryegrass, and prickly sida were investigated in laboratory experiments. Liquid extracts of cogongrass foliage and root residues at concentrations of 0, 0.25, 0.5, 1, 2, 4, and 8% were evaluated on bermudagrass and Italian ryegrass. Effects of 8% foliage or root residue extracts were investigated on hemp sesbania, prickly sida, barnyardgrass, and browntop millet. Cogongrass residue (foliage and root) extracts at concentrations as low as 0.5% inhibited germination and seedling growth of bermudagrass and Italian ryegrass. Germination of bermudagrass and Italian ryegrass was reduced by as much as 62% and radicle and coleoptile growth by as much as 96% at the highest extract concentrations. Foliage and root residue extracts reduced germination of barnyardgrass, browntop millet, and prickly sida 52 to 64% and seedling growth by as much as 96%. Cogongrass extracts had no effect on germination or seedling development of hemp sesbania. Results indicate that extracts of cogongrass may contain allelochemicals that may contribute to its invasiveness and extreme competitiveness.

Nomenclature: Barnyardgrass, *Echinochloa crus-galli* (L.) Beauv. #³ ECHCG; bermudagrass, *Cynodon dactylon* (L.) Pers. # CYNDA; browntop millet, *Brachiaria ramosa* (L.) Stapf. # PANRA; cogongrass, *Imperata cylindrica* (L.) Beauv. # IMPCY; hemp sesbania, *Sesbania exaltata* (Raf.) Rydb. Ex A. W. Hill # SEBEX; Italian ryegrass, *Lolium multiflorum* Lam. # LOLMU; prickly sida, *Sida spinosa* L. # SIDSP.

Additional index words: Allelopathy, coleoptile, germination, plant extracts, plant residues, radicle.

INTRODUCTION

Cogongrass, also called Japgrass, blady grass, speargrass, *alang-alang*, and *lalang-alang*, is a C₄, rhizomatous, perennial weed with culms that grow erect to ascending and typically reaches heights of 1.2 m but can grow to heights of 3 m (Brown 1944; Holm et al. 1977; Hubbard 1944). It has an extensive fibrous root system arising from creeping, scaly rhizomes. Cogongrass is among the most troublesome weeds worldwide (Falvey 1981; Holm et al. 1977). It grows in tropical, subtropical, and some temperate regions of the world (Akobundo and Agyakwa 1998; Bryson and Carter 1993) and is found in all continents except Antarctica (Holm et al. 1977; Hubbard 1944). It was introduced in the southern United States in the late 19th and early 20th centuries (Dickens 1974; Dickens and Buchanan 1971). Today, cogongrass

is an invasive weed in many gulf states of the southeastern United States (Byrd and Bryson 1999; Dickens 1974; Elmore 1986). Spread of cogongrass beyond the southeastern United States may be limited owing to its reduced competitiveness under cooler environmental conditions and lack of low-temperature tolerance (Wilcut et al. 1988). However, it has been found at latitudes of 45° in both the northern and the southern hemispheres (Holm et al. 1977), so the potential for spread to new areas of the southern United States exists.

Cogongrass spreads mainly by way of seeds and rhizomes (Dozier et al. 1998). Once established, it is extremely competitive with crops and neighboring plant communities. In corn (*Zea mays* L.), grain yield reductions of 80 to 100% (Koch et al. 1990; Udensi et al. 1999) have been reported. Koch et al. (1990) also reported >90% yield reduction for intercropped corn and cassava (*Manihot esculenta* Crantz). In the United States, cogongrass is currently not a problem in cultivated areas because of its susceptibility to frequent soil disturbance (Hartley 1949; Patterson 1980). Cogongrass thrives in infrequently cultivated areas, utility right-of-ways, roadsides, forests, pastures, mining areas, pine plantations,

¹ Received for publication January 10, 2003, and in revised form July 21, 2003.

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³ Letters following this symbol are a WSSA-approved computer code from *Composite List of Weeds*, Revised 1989. Available only on computer disk from WSSA, 810 East 10th Street, Lawrence KS 66044-8897.

parks, and other natural and recreational areas (Colie and Shilling 1993; Dozier et al. 1998; Willard et al. 1990).

Extensive research has been conducted on biological properties of cogongrass such as temperature tolerance (Wilcut et al. 1988), shade tolerance (Gaffney 1996), reproductive characterization and capabilities (Holm et al. 1977; Hubbard 1944; McDonald et al. 1996), and growth potential (Sajise 1972; Soerjani 1970). However, limited research has been conducted on potential allelopathic inhibition of species commonly found in terrestrial areas similar to those of cogongrass. Cogongrass residues have been found to reduce germination and early development of rice (*Oryza sativa* L.) in aquatic systems. Casini et al. (1998) found that cogongrass residues reduced rice germination 11 to 15% and plant height and leaf number per plant 22 and 43%, respectively. Phenolic compounds present in foliage, roots, and rhizomes of cogongrass may be responsible for the allelopathic inhibition of germination and seedling development of other species as well. Inderjit and Dakshini (1991) reported that several phenolic compounds extracted from leachates of cogongrass foliage and roots or rhizomes reduced germination and shoot and root length of mustard [*Brassica juncea* (L.) Czern and Coss.] and tomato (*Lycopersicon esculentum* Mill.). Inderjit and Dakshini (1991) also found phenolic compounds in leachates of soil collected near the rhizosphere of cogongrass as well as up to 3 m away that were not present in control soils. However, information on the effect of cogongrass residues on grasses common to terrestrial areas such as roadsides, pastures, mining areas, parks, and other natural and recreational areas is lacking. Therefore, the objectives of this research were to determine the effect of cogongrass residues on germination and seedling growth of bermudagrass and Italian ryegrass, two desirable grasses commonly found in similar areas as those of cogongrass, as well as various annual dicotyledonous and monocotyledonous weed species.

MATERIALS AND METHODS

Cogongrass Residue Preparation. Residues used in the studies were prepared by harvesting foliage and root biomass of mature plants from an established monoculture stand of cogongrass located at the USDA Southern Weed Science Research Farm, Stoneville, MS (33°N). The soil was a Dundee silt loam (fine-silty, mixed, thermic Aeric ochraqualfs) with soil textural fractions of 26% sand, 55% silt, and 19% clay. Organic matter, pH, and cation exchange capacity were 1.1%, 6.3, and 15 cmol/kg, respectively. Foliage and root biomass were harvested in

mid-August 2002, when plants were 60 to 92 cm in height and in the postbloom growth stage. The average cogongrass shoot density was 685 shoots/m², which is similar to densities at a utility right-of-way, a roadside, and an abandoned pasture site in Mississippi (804, 554, and 786 shoots/m², respectively).

Cogongrass foliage was harvested by clipping all aboveground biomass from 20 randomly selected 31- by 31-cm areas within the solid stand of cogongrass. After removing foliage, the top 15 cm of soil plus root biomass was removed with a shovel from the same 31- by 31-cm areas where the foliage was harvested. Four 5-cm-diam by 15-cm-deep soil cores (soil moisture cores) also were collected adjacent to the 31- by 31-cm sampling areas with a hand soil probe, weighed, and sealed in plastic bags so that soil moisture could be determined. Foliage and soil plus root samples were placed in separate plastic bags that were sealed and placed in coolers for transport to the laboratory. Soil plus root samples were weighed before washing roots free of soil with water. Foliage and root samples and soil moisture cores were then placed in a forced-air oven and dried at 45 C. Each sample was weighed, and foliage and root biomass samples were ground in a Wiley mill equipped with a 1-mm-mesh sieve. Ground foliage and root samples were mixed separately in sealed plastic bags to comprise a single foliage and single root biomass sample. Residue for foliage and roots were then placed in separate screw-top sterilized plastic bottles and stored in the dark at 4 C until further use.

Cogongrass Extract Preparation. Concentrations of cogongrass foliage and root residue extracts were determined according to observed foliage-root-soil concentrations (wt/wt/wt) in the field from which samples were obtained. The total dry weight of foliage plus root plus soil collected from the 31-cm-long by 31-cm-wide by 15-cm-deep sampling areas ranged from 21 to 27 kg. The proportion of dry to wet weight of the soil moisture cores was used to account for the weight of moisture in the soil plus root samples. Foliage accounted for 0.78 to 2.35% of the total sample dry weight, whereas roots accounted for 4.2 to 7.3%. Thus, the residue extract concentrations evaluated for foliage and root residue on a separate basis were 0, 0.25, 0.5, 1.0, 2.0, 4.0, and 8.0%.

Foliage and root residue extracts were obtained by mixing the designated amount of residue (wt/v) for each concentration with 200 ml double-distilled deionized water (DDDW) in a glass Waring⁴ blender for 10 min at

⁴ Waring Commercial, 314 Ella T. Grasso Avenue, Torrington, CT 06790.

18,000 rpm. For example, 16 g of residue (foliage or root) was mixed with 200 ml DDDW for the 8% wt/v concentration. The blender was triple rinsed with DDDW between each mixing. After mixing, residue–DDDW solutions were filtered through four layers of cheesecloth, vacuum filtered through two layers of filter paper,⁵ and then centrifuged at 3,000 rpm for 30 min in sterilized 250-ml polypropylene bottles. The supernatant was removed and filtered through a sterilized 0.2- μ m nylon low-extractable membrane into sterilized 250-ml filter bottles.⁶ Filtrations were performed with air-driven pumps under a fume hood at 27 C. The nontreated check (0% residue) extract consisted of DDDW and went through the same mixing and filtration procedures as the residue extracts. Average pH of cogongrass extracts was 5.96 ± 0.6 , and average electric conductivity was $507 \pm 109 \mu\text{S}/\text{cm}$. The nontreated check had a pH of 5.91 and electric conductivity of $535 \mu\text{S}/\text{cm}$. All extracts were stored in the filter bottles at 4 C in complete darkness until future use.

Bermudagrass and Ryegrass Study. Twenty-five seeds of bermudagrass (CYNDA) and Italian ryegrass (LOLMU)⁷ were placed between two filter papers⁵ in separate presterilized 9-cm plastic petri dishes. Five milliliters of each extract was added to four petri dishes with CYNDA seeds and four with LOLMU seeds, resulting in four replications of each species (CYNDA and LOLMU) by cogongrass residue (foliage and root) extract combination. Petri dishes were wrapped with parafilm⁸ and placed inside transparent self-sealed plastic bags to minimize water losses from evaporation. Petri dishes were incubated under complete darkness for 6 d in a growth chamber at 35/24 C for 16/8-h periods. Relative humidity was maintained at 80% for the entire 6-d period. Based on a preliminary study, seeds of CYNDA and LOLMU subjected to DDDW or the highest concentration of foliage or root residue extract began to germinate by the third day of incubation and reached maximum germination by the end of the sixth day. Thus, germination of CYNDA and LOLMU was determined by visible radicle protrusion after a 6-d incubation period, and radicle and coleoptile length for each germinated seed was also recorded.

Weed Study. Twenty-five seeds of barnyardgrass (ECHCG), browntop millet (BRARA), hemp sesbania (SEBEX), and prickly sida (SIDSP),⁷ were placed be-

tween two filter papers⁵ in separate 9-cm petri dishes. Five milliliters of the 8% foliage, 8% root, and nontreated control extracts were placed in four separate petri dishes for each weed species. Petri dishes were wrapped in parafilm to reduce water evaporation. Petri dishes containing ECHCG and BRARA were then wrapped with two layers of aluminum foil, and all petri dishes were placed in transparent sealed plastic bags. Petri dishes were incubated for 6 d under fluctuating day/night temperatures (35/24 C) for 16/8-h periods. Photoperiod was set at 16 h to coincide with high temperature. Fluorescent lamps were used to produce a photosynthetic photon flux density of $200 \mu\text{mol}/\text{m}^2/\text{s}$. Relative humidity was maintained at 80% for the entire 6-d period. Germination, radicle, and coleoptile data were recorded after the 6-d incubation period as described previously (CYNDA and LOLMU study). Seeds of all weed species subjected to DDDW or the highest concentration of foliage and root residues began to germinate by the second to third day of incubation and reached maximum germination after a 6-d incubation period.

Statistical Analysis. A randomized complete block design with four replications was used in all experiments. Each experiment was conducted twice. Data were subjected to ANOVA and tested for homogeneity of error variance. Arcsine square-root transformations did not improve variance homogeneity, thus nontransformed data were used in all analyses. Germination, radicle, and coleoptile data for the nontreated check of the CYNDA and LOLMU study were set to 100% and thus were excluded from the analysis to stabilize variance. Data for both studies were subjected to Proc Mixed with sum of squares partitioned to reflect a factorial treatment structure for each study (SAS 2001). Factors included plant species, type of cogongrass residue extract (foliage or root), and extract concentration. Replication was deemed as a random variable, with plant species and cogongrass extract type and concentration considered fixed variables. Germination, radicle, and coleoptile data for the CYNDA and LOLMU study were presented as a percentage of the nontreated check. Polynomial regression analysis and ANOVA were used to determine the effect of foliage and root extract concentration on germination and radicle and coleoptile growth of CYNDA and LOLMU. Pseudo R^2 values were calculated to assess the goodness of fit for individual regression equations. R^2 values were obtained by subtracting the ratio of the residual sum of squares to the corrected total sum of squares from one. The residual sum of squares was attributed to that variation not explained by the fitted line.

⁵ Whatman #1, Fisher Scientific, 711 Forbes Avenue, Pittsburgh, PA 15219.

⁶ Corning Inc., 114 Pine Street, Corning, NY 14831.

⁷ Azlin Seed Service, P.O. Box 914, Leland, MS 38756.

⁸ Parafilm, American National Company, 101 Merritt 7, Norwalk, CT 06856.

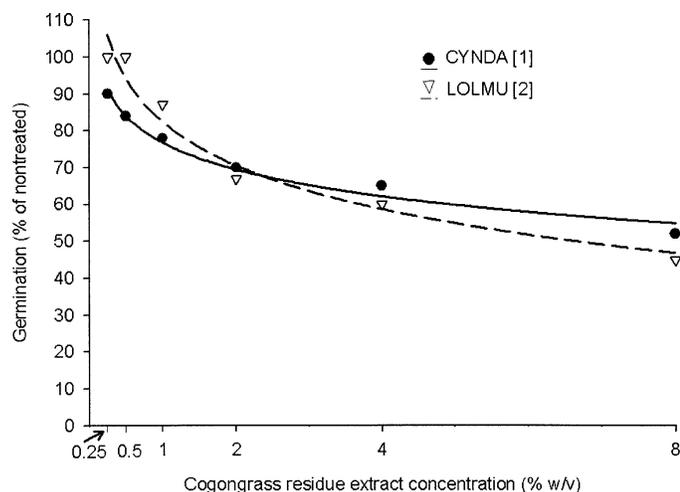


Figure 1. Effect of cogongrass residue on germination of bermudagrass (CYNDA) and Italian ryegrass (LOLMU) seed. Germination data were pooled across foliage and root residue for both grasses because there was no significant effect from type of cogongrass residue. Regression equations: (1) $y = -10.5 \ln(x) + 76.8$, $R^2 = 0.98$; (2) $y = -17.1 \ln(x) + 82.4$, $R^2 = 0.95$.

The R^2 and residual mean squares were used to determine the goodness of fit to polynomial models. For the weed study, germination and radicle and coleoptile mean values were separated using Fisher's protected least significance difference test at $P = 0.05$. Data represent the average of the two experiments for each study because no experiment by treatment interaction occurred.

RESULTS AND DISCUSSION

Bermudagrass and Ryegrass. Germination for nontreated CYNDA and LOLMU was 80 and 88%, respectively, when averaged across experiments (data not shown). Average radicle and coleoptile lengths were 27 and 16 mm for CYNDA and 40 and 21 mm for LOLMU, respectively.

Foliage and root residue extracts of cogongrass reduced germination of both grass species (CYNDA and LOLMU). However, there was no difference in the type of cogongrass residue extract (foliage and root) with respect to germination reduction of either species; therefore, germination of CYNDA and LOLMU over increasing cogongrass residue extract concentration was fitted to regression curves pooled across type of cogongrass extract for each grass species (Figure 1). Regression curves for germination of both species best fit a nonlinear model, with quadratic reduction in germination as cogongrass residue extract concentration increased. Cogongrass residue concentrations as low as 1% for LOLMU and 0.25% for CYNDA reduced germination compared with the nontreated check. Germination of LOL-

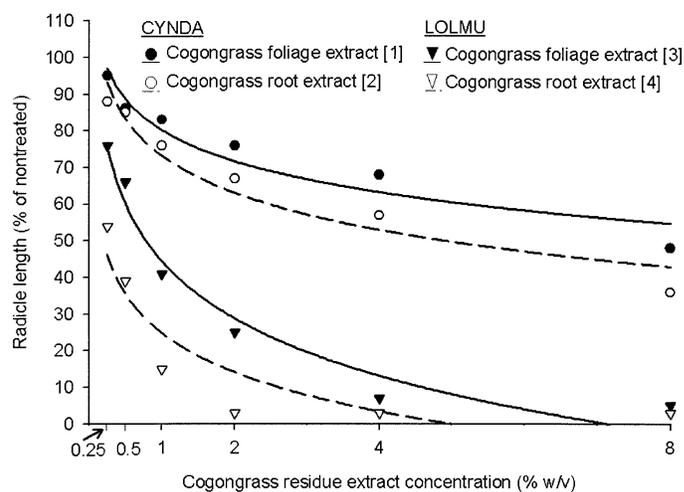


Figure 2. Effect of cogongrass foliage and root residue on bermudagrass (CYNDA) and Italian ryegrass (LOLMU) radicle length. Regression equations: (1) $y = -12.2 \ln(x) + 80.2$, $R^2 = 0.92$; (2) $y = -14.5 \ln(x) + 73.2$, $R^2 = 0.94$; (3) $y = -22.6 \ln(x) + 44.5$, $R^2 = 0.96$; (4) $y = -15.5 \ln(x) + 24.8$, $R^2 = 0.83$.

MU ranged from 100% of the nontreated check at the lowest residue concentration (0.25%) to 45% at the highest residue concentration. Germination of CYNDA followed a similar trend as that of LOLMU, with germination ranging from 90 to 54% between the lowest and highest residue concentrations. Cogongrass residues have also been found to reduce germination of other desirable grasses. Casini et al. (1998) reported that germination of rice was reduced by as much as 15% in the presence of cogongrass residues at lower concentrations (1 to 3%) than those investigated in this study.

Radicle length of CYNDA and LOLMU was reduced by foliage and root residues of cogongrass (Figure 2). Reduction in radicle length for both grasses followed a similar trend as germination, with a nonlinear quadratic reduction in radicle length as concentration of cogongrass residue increased. Radicle growth of LOLMU was more sensitive to cogongrass residues than that of CYNDA. Radicle length of LOLMU was 4 to 77% of the nontreated check compared with 45 to 95% for CYNDA. Additionally, radicle length of LOLMU and CYNDA was 14% shorter with root residues than with foliage residues when averaged across residue concentration. Radicle length of CYNDA was 55 to 95% and 45 to 88% of the nontreated check when exposed to foliage and root residues and was significantly different between the two residue sources only at the 4 and 8% residue concentrations. LOLMU radicle length ranged from 10 to 77% of the nontreated check for foliage residues and 4 to 55% for root residues, with the 4 and 8% concentrations of foliage and root residues resulting in the larg-

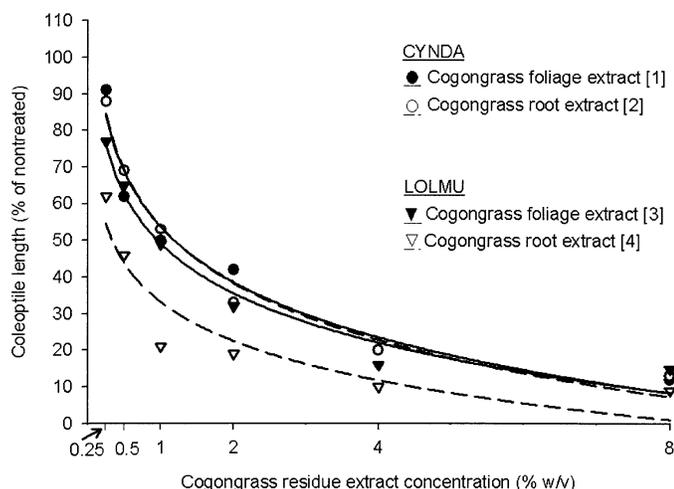


Figure 3. Effect of cogongrass foliage and root residue on bermudagrass (CYNDA) and Italian ryegrass (LOLMU) coleoptile length. Regression equations: (1) $y = -21.8 \ln(x) + 53.7$, $R^2 = 0.96$; (2) $y = -22.3 \ln(x) + 53.7$, $R^2 = 0.98$; (3) $y = -19.5 \ln(x) + 49.1$, $R^2 = 0.97$; (4) $y = -15.4 \ln(x) + 33.2$, $R^2 = 0.88$.

est reduction in radicle length for both species (>11% of the nontreated radicle length).

Coleoptile length of both grasses best fit a quadratic reduction with increasing concentration of cogongrass foliage and root residues (Figure 3). Coleoptile length of both species was significantly reduced with each increase in concentration of cogongrass residue up to the 4% concentration level. For both cogongrass residues, there was no difference in coleoptile length of either species between the 4 and 8% residue concentrations. Coleoptile growth of LOLMU was affected more than that of CYNDA, with LOLMU coleoptile lengths of 5% of the nontreated check with the highest concentration of cogongrass root residue to 78% with the lowest concentration of foliage residue compared with 20 to 92% (foliage and root residues) for CYNDA. Root residues of cogongrass reduced LOLMU coleoptile length more than foliage residues, with coleoptile lengths of 5 to 62% of the nontreated check for root residues compared with 12 to 78% for foliage residues. Type of cogongrass residue did not affect CYNDA coleoptile length, which ranged from 20 to 26% of the nontreated check at the 4 and 8% concentration of foliage and root residue to 92% at the lowest residue (foliage and root) concentration.

Overall, CYNDA and LOLMU responded similarly to foliage and root residues of cogongrass, with a nonlinear reduction in germination as well as radicle and coleoptile growth. The nonlinear response for each parameter was attributed to substantial reduction with an increase in residue concentrations between 0.25 and 2%, and a leveling off in reduction between the 4 and 8% concentrations.

Thus, there was often little difference between the 4 and 8% concentrations for each type of cogongrass residue with respect to germination and seedling growth of both grasses. In general, root residues were more suppressive of radicle and coleoptile growth of both grasses. However, in most cases, both types of residue reduced germination and length of radicles and coleoptiles for both grasses at residue concentrations as low as 0.5%.

Other species have also been found to elicit allelopathic substances and in turn inhibit germination and growth of CYNDA and LOLMU. Aqueous extracts of sericea lespedeza [*Lespedeza cuneata* (Dum. De Cours) G. Don] foliage have been found to inhibit the growth of CYNDA (Kalburji and Mosjidis 1992). Similarly, aqueous extracts of wheat (*Triticum aestivum* L.), corn, bitter sneezeweed [*Helenium amarum* (Raf.) H. Rock], crimson clover (*Trifolium incarnatum* L.), and hairy vetch (*Vicia villosa* Roth.) reduced germination and growth of LOLMU (Smith 1989; White et al. 1989; Wu et al. 2000). Wu et al. (2000) also found several phenolic compounds such as *p*-hydroxybenzoic acid, vanillic, *p*-coumaric, syringic, and ferulic in the roots of wheat to inhibit growth of LOLMU. Even though work regarding the potential presence of isolated phenolic compounds in tissue of cogongrass has not been published, several phenolic fractions present in leachates of cogongrass leaves and roots have been found to inhibit germination and growth of mustard and tomato (Inderjit and Dakshini 1991).

Weeds. Percent germination and length of radicles and coleoptiles for nontreated weeds are listed in Table 1. Foliage and root residue (8% concentration of each) extracts of cogongrass reduced germination as well as radicle and coleoptile length of SIDSP, ECHCG, and BRARA (Table 1). Cogongrass residues had no effect on germination or radicle and coleoptile length of SEBEX. Additionally, there was no difference between foliage and root residues of cogongrass with respect to reduction in germination or radicle and coleoptile length of SIDSP, ECHCG, and BRARA. Germination of SIDSP, ECHCG, and BRARA was reduced 52 to 64% by both residue types. In general, radicle and coleoptile growth of ECHCG and BRARA was more sensitive to cogongrass residues than that of SIDSP. ECHCG and BRARA radicle and coleoptile length was reduced 75 to 96% compared with the nontreated check, whereas radicle and coleoptile length of SIDSP was reduced 66 to 73%, respectively. The lack of suppression of SEBEX was expected. Most legumes are able to grow in conjunction with cogongrass. In some cases, legumes planted for

Table 1. Effect of cogongrass foliage and root residue extract (8% wt/v) on germination and length of radicle and coleoptile of hemp sesbania (SEBEX), prickly sida (SIDSP), barnyardgrass (ECHCG), and browntop millet (BRARA).^a

| Cogongrass extract | SEBEX | | | SIDSP | | | ECHCG | | | BRARA | | |
|-------------------------|-------------------|-------|-------|-------------------|-------|-------|-------------------|-------|-------|-------------------|-------|-------|
| | Germ ^b | RadLT | ColLT |
| | % | mm | | % | mm | | % | mm | | % | mm | |
| Nontreated ^c | 48 | 34 | 15 | 80 | 15 | 15 | 64 | 23 | 16 | 76 | 20 | 18 |
| Foliage ^d | 40 | 32 | 16 | 24 | 5 | 5 | 12 | 5 | 3 | 20 | 5 | 2 |
| Root ^d | 44 | 31 | 14 | 28 | 4 | 5 | 8 | 1 | 2 | 12 | 2 | 1 |
| LSD (0.05) | NS | NS | NS | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

^a Abbreviations: Germ, germination; RadLT, radicle length; ColLT, coleoptile length.

^b Percentage of seeds of a possible 25 per petridish for each cogongrass extract treatment that germinated after a 6-d incubation period.

^c Weed seeds were exposed to 5 ml of double-distilled deionized water.

^d Weed seeds were exposed to 5 ml of an 8% wt/v cogongrass–double-distilled deionized water extract solution.

cover crops, enhancement of soil-nitrogen levels, and grazing forage are capable of controlling or substantially reducing vigor of cogongrass (Anoka et al. 1991; Anonymous 1995; Udensi et al. 1999).

The 8% cogongrass residue concentration evaluated on the weed species may be higher than the concentrations actually observed in field settings because the cogongrass root concentration documented in the solid-stand infestation for this research was 4.2 to 7.3%. However, documenting the potential inhibition of both monocot and dicot species while exhibiting selectivity in species inhibition at the most lethal concentration was important. Based on these findings, legume species may have potential for introduction into cogongrass areas or into areas where cogongrass has been recently controlled.

Extracts of cogongrass foliage and root residues inhibited germination and seedling growth of CYNDA, LOLMU, and three of the four weed species investigated. Cogongrass residues were selective in nature by not reducing germination or seedling development of SEBEX. Foliage and root residues of cogongrass often suppressed germination and seedling development of both grasses and the affected weed species at similar levels, with only radicle growth being reduced more by root residues than by foliage residues. Both foliage and root growth of cogongrass may contain an allelopathic substance(s) that elicits a competitive advantage for cogongrass by suppressing germination and seedling growth of desirable grasses.

Based on this research, cogongrass may contain some type of allelopathic substance(s) that contributes to its extreme invasiveness and competitiveness. Phenolic fractions found in cogongrass tissue have been found to inhibit germination and growth of other species (Inderjit and Dakshini 1991) as well. However, specific phenolic compounds have not been identified and tested for al-

lelopathic properties. Specific phenolic compounds such as *p*-hydroxybenzoic, *p*-hydroxybenzaldehyde, vanillic, syringic, *p*-coumaric, and ferulic have been found in other monocot species such as sorghum [*Sorghum bicolor* (L.) Moench.] to inhibit wheat and peanut (*Arachis hypogaea* L.) (Ben-Hammouda et al. 1995; Sene et al. 2000). To determine the phytotoxicity of a potential allelopathic substance in cogongrass, the substance must first be isolated and tested alone for activity on other species. The allelopathic potential of an isolated compound also must be tested in a medium, such as soil. It is important to show that the chemical(s) contributed by the allelopathic species (i.e., cogongrass) is primarily responsible for the growth inhibition of desirable species under conditions similar to those of field situations. Additionally, the phytotoxic nature of an isolated compound needs testing. Others have found allelopathic compounds to inhibit the uptake or reduce the availability of inorganic ions (Kaur and Foy 2001), inhibit chlorophyll development (Blum 1999), or disrupt cellular membranes (Tanaka et al. 1993). The inhibitory mode of action of the compound must be identified so that the true allelopathic nature of the compound toward desirable plant species can be better understood.

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