

## A Survey of Weeds in Various Crops in Georgia<sup>1</sup>

THEODORE M. WEBSTER and GREGORY E. MACDONALD<sup>2</sup>

**Abstract:** A survey of county extension agents was conducted in 1998 to determine the most troublesome weeds in corn, cotton, forages and pastures, peanut, small grains, soybean, tobacco, and vegetables in Georgia. The most troublesome weed statewide averaged over all crops was sicklepod. It was the most troublesome weed in cotton and soybean and among the four most troublesome weeds in corn, peanut, tobacco, and vegetables. Sicklepod was found in each of the nine climatological districts and in all the crops surveyed. Perennial nutsedge species were the second most troublesome weeds in Georgia. They ranked as the most troublesome weeds in tobacco and vegetables and were among the top five most troublesome weeds in corn, cotton, peanut, and soybean. Pigweed species were ranked third averaged over all the crops surveyed and were the second most troublesome weeds in cotton and vegetables and among the top five most troublesome species in corn, soybean, and tobacco. Morningglory species were listed as troublesome in six of the eight crops surveyed and ranked fourth overall. Similarly, Texas panicum was found in all districts and was the fifth most troublesome weed species. Texas panicum was the most troublesome weed in corn and among the top five most troublesome weeds in peanut, soybean, and tobacco. Florida beggarweed was the most troublesome weed in peanut, the second most troublesome weed in tobacco, and a top-10 weed species in corn, cotton, soybean, and vegetables, resulting in a ranking of sixth overall. Wild radish, large crabgrass, and tropic croton were the seventh through the ninth most troublesome weeds. Wild radish was the most troublesome weed of small grains and the sixth most troublesome weed of vegetables. Large crabgrass was the second most troublesome weed of forages and pastures and was reported in six other crops. Tropic croton was a troublesome weed in seven of the eight crops surveyed and was among the top five most troublesome weeds of cotton and peanut. The 10th most troublesome weed overall was bahiagrass, the most troublesome weed of forages and pastures.

**Nomenclature:** Bahiagrass, *Paspalum notatum* Fluegge #<sup>3</sup> PASNO; Florida beggarweed, *Desmodium tortuosum* (Sw.) DC. # DEDTO; large crabgrass, *Digitaria sanguinalis* L. # DIGSA; morningglory species, *Ipomoea* spp.; nutsedge species, *Cyperus* spp.; pigweed species, *Amaranthus* spp.; sicklepod, *Senna obtusifolia* (L.) Irwin and Barnaby # CASOB; Texas panicum, *Panicum texanum* Buckl. # PANTE; tropic croton, *Croton glandulosus* var. *septentrionalis* Muell.-Arg. # CVNGS; wild radish, *Raphanus raphanistrum* L. # RAPSN; corn, *Zea mays* L.; cotton, *Gossypium hirsutum* L.; peanut, *Arachis hypogaea* L.; soybean, *Glycine max* (L.) Merr.; tobacco, *Nicotiana tabacum* L.

**Additional index words:** Economically important weeds, weed distributions, weed population shifts, weed survey.

**Abbreviations:** C, Central district; EC, East-Central district; NC, North-Central district; NE, North-eastern district; NW, Northwestern district; SC, South-Central district; SE, Southeastern district; SW, Southwestern district; SWSS, Southern Weed Science Society; WC, West-Central district.

<sup>1</sup> Received for publication December 9, 1999, and in revised form June 18, 2001.

<sup>2</sup> Research Agronomist, Crop Protection and Management Research Unit, USDA-ARS, P.O. Box 748, Tifton, GA 31793-0748; Former Associate Professor, Department of Crop and Soil Sciences, University of Georgia, Tifton, GA 31793-0748. Current address of second author: Department of Agronomy, University of Florida, Gainesville, FL 32611-0500. Corresponding author's E-mail: twebster@tifton.cpes.peachnet.edu.

<sup>3</sup> 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.

## INTRODUCTION

A weed survey is necessary to evaluate current weed problems throughout a given geographical area (Boldt et al. 1998; Doll and Quinones 1983; Ervio and Salonen 1986; Mack 1981). Survey information can impact research and extension programs in several ways, including the following: (1) research programs can target weed species identified as being important (Coble 1994; Elmore 1984); (2) county cooperative extension agents can coordinate efforts to develop educational programs across county lines (Loux and Berry 1991); and (3) surveys can be used to evaluate the rate of weed species shifts in a given area (Ervio and Salonen 1986; Loux and Berry 1991; Webster and Coble 1997).

Annual surveys of primary weed problems within the Southern United States have been completed by weed scientists of the Southern Weed Science Society (SWSS) since 1971. These surveys are a valuable tool to document changes in weed species as weed management systems have evolved. Summaries of these surveys were reported in 1984 and 1997 (Elmore 1984; Webster and Coble 1997), and important changes were observed over this 13-yr period. Johnsongrass [*Sorghum halepense* (L.) Pers.] was the most troublesome weed in cotton in 1983, but only the ninth most troublesome species in 1995 (Webster and Coble 1997). Common cocklebur (*Xanthium strumarium* L.) was the most important species in peanut in 1974; however, by 1983 and 1995 it had fallen to only the seventh most important species (Elmore 1984; Webster and Coble 1997). The addition of new herbicides for the control of johnsongrass in cotton and common cocklebur in peanut has shifted these species from being the most troublesome weeds to the status of important, but subordinate, weeds.

The purpose of the current survey was not to supercede the information contained in the annual SWSS surveys, but to provide a survey with a different geographical scale of resolution. Instead of grouping the different regions of the state together, the objective of this survey was to evaluate the most troublesome weeds in each of eight crops in nine different climatological districts in Georgia.

## MATERIALS AND METHODS

**Survey.** In 1998 a questionnaire was sent to all Georgia county Cooperative Extension offices in Georgia. The surveys asked the county cooperative extension agents to identify the most troublesome weeds within their county for each of eight crops. Troublesome weeds were

defined as those species that are difficult to control, interfere with crop growth, reduce yield, hinder harvesting operations, and/or reduce crop quality. The respondents were asked to list and rank the five most troublesome weeds in each crop. The eight crops in the survey included corn, cotton, forages and pastures, peanut, small grains (wheat [*Triticum aestivum* L.], oat [*Avena sativa* L.], and rye [*Secale cereale* L.]), soybean, tobacco, and vegetable crops. Of the 159 counties within the state, surveys from 110 counties were completed and returned (69%). Counties that completed the surveys accounted for 83 to 89% of the corn, cotton, peanut, soybean, and tobacco hectares, 61% of the small grain hectares, and 71% of the vegetable hectares.

Common and scientific names of the weeds referred to in this survey can be found in Table 1. Due to the lack of specificity in weed names in the completed surveys, many weeds are referred to only by the genus. For example, many respondents only cited nutsedge as a troublesome weed. Instead of attempting to differentiate yellow nutsedge (*Cyperus esculentus* L.) from purple nutsedge (*Cyperus rotundus* L.), a generic nutsedge species category was created. Other weeds that were treated in this manner included buttercup species (*Ranunculus* spp.), brambles (*Rubus* spp.), cacti (*Opuntia* spp.), chickweed species (*Stellaria* spp.), fescue species (*Festuca* spp.), foxtail species (*Setaria* spp.), groundcherry species (*Physalis* spp.), morningglory species (*Ipomoea* spp. and *Jacquemontia* spp.), nightshade species (*Solanum* spp.), pepperweed species (*Lepidium* spp.), pigweed species, plantain species (*Plantago* spp.), purslane species (*Portulaca* spp.), sandbur species (*Cenchrus* spp.), spurge species (*Euphorbia* spp.), and thistle species {bull thistle [*Cirsium vulgare* (Savi) Tenore] and musk thistle [*Carduus nutans* L.]}. There were some exceptions involving pigweed species. Respondents separated spiny amaranth (*Amaranthus spinosus* L.) and Palmer amaranth (*Amaranthus palmeri* S. Wats.) from other species of pigweed.

**Data Analysis.** Data from each county were weighted to reflect the rank in the survey and the number of hectares of the specified crop grown in the county (Elmore 1984). Within a crop and a county, each weed was ranked from one to five. For instance, the most troublesome weed in the list was assigned a value of five, the second most troublesome weed a value of four, etc. for the five weeds listed for each crop, similar to the method proposed by Elmore (1983).

The weed rankings were multiplied by the number of



Figure 1. A map of the nine climatological districts in Georgia and the counties that comprise each district.

hectares of that crop grown in that county in 1997,<sup>4</sup> using a method proposed by Elmore (1984). This value was the weighted weed ranking, which accounts for a weed's order in the survey and the importance of the county's crop production relative to the statewide production of that crop. This system is biased to reflect the responses from the counties with large crop-producing areas; however, this system achieves the purpose of the survey, which was to determine the most troublesome weeds for each crop in Georgia. A listing of forage and pasture hectares for each county was not available. Therefore, no weighting based on hectares was done within the for-

ages and pastures component of the survey. The total number of hectares for forages and pastures in Georgia was available and used in other analyses.

Due to the diverse agricultural regions within Georgia, the state has been partitioned into nine climatological districts which divide the state into three parts from North to South and from East to West (Figure 1). Throughout the remainder of the discussion, the districts will be referred to by their geographical distribution.

The weighted weed rankings from each county within a district were pooled, and the troublesome weeds within each district were determined. A sum of weighted values across districts yielded the most troublesome species in Georgia for each crop. The most troublesome species

<sup>4</sup> Georgia Agricultural Facts 1998, Georgia Agricultural Statistics Service, Athens, GA 30601.

Table 1. Scientific names, common names, and Bayer codes of weeds in the Georgia weed survey.

Scientific name	Common name	Bayer code
<i>Abutilon theophrasti</i> Medik.	Velvetleaf	ABUTH
<i>Acalypha ostryfolia</i> Riddell	Hophornbeam copperleaf	ACCOS
<i>Acanthospermum hispidum</i> DC.	Bristly starbur	ACNHI
<i>Agrostemma githago</i> L.	Corn cockle	AGOGI
<i>Allium</i> spp.	<i>Allium</i> species	* <sub>a</sub>
<i>Amaranthus palmeri</i> S. Wats.	Palmer amaranth	AMAPA
<i>Amaranthus</i> species	Pigweed species	*
<i>Amaranthus spinosus</i> L.	Spiny amaranth	AMASP
<i>Ambrosia artemesifolia</i> L.	Common ragweed	AMBEL
<i>Andropogon virginicus</i> L.	Broomsedge	ANOVI
<i>Anthemis</i> species	Chamomiles	*
<i>Arachis hypogaea</i> L.	Peanut	
<i>Bracharia platyphylla</i> (Griseb.) Nash	Broadleaf signalgrass	BRAPP
<i>Campsis radicans</i> (L.) Seem. Ex Bureau	Trumpet creeper	CMIRA
<i>Capsella bursa-pastoris</i> (L.) Medik.	Shepherd's-purse	CAPBP
<i>Carduus nutans</i> L.	Musk thistle	CRUNU
<i>Cassia occidentalis</i> L.	Coffee senna	CASOC
<i>Cenchrus</i> species	Sandburs	*
<i>Chenopodium album</i> L.	Common lambsquarters	CHEAL
<i>Cirsium vulgare</i> (Savi) Tenore	Bull thistle	CIRVU
<i>Citrullus lanatus</i> var. <i>citroides</i> (Bailey) Mansf.	Citronmelon	CITLC
<i>Cleome hassleriana</i> Chodat	Spiderflower	CLEHA
<i>Commelina</i> species	Dayflowers	*
<i>Conyza canadensis</i> (L.) Cronq.	Horseweed	ERICA
<i>Coronopus didymus</i> (L.) Sm.	Swinecress	COPDI
<i>Crotalaria spectabilis</i> Roth.	Showy crotalaria	CVTSP
<i>Croton glandulosus</i> var. <i>septrionalis</i> Muell.-Arg.	Tropic croton	CVNGS
<i>Cucumis anguria</i> L.	Burgherkin	CUMAN
<i>Cynodon dactylon</i> (L.) Pers.	Common bermudagrass	CYNDA
<i>Cyperus compressus</i> L.	Annual sedge	CYPCP
<i>Cyperus</i> species	Nutsedge species	*
<i>Desmodium tortuosum</i> (Sw.) DC.	Florida beggarweed	DEDTO
<i>Digitaria sanguinalis</i> (L.) Scop.	Large crabgrass	DIGSA
<i>Diospyros virginiana</i> L.	Common persimmon	DOSVI
<i>Eclipta prostrata</i> L.	Eclipta	ECLAL
<i>Eleusine indica</i> (L.) Gaertn.	Goosegrass	ELEIN
<i>Eupatorium capillifolium</i> (Lam.) Small	Dogfennel	EUPCP
<i>Euphorbia heterophylla</i> L.	Wild poinsettia	EPHHL
<i>Euphorbia</i> species	Spurges	*
<i>Festuca</i> species	Fescues	*
<i>Geranium carolinianum</i> L.	Carolina geranium	GERCA
<i>Gnaphalium</i> species	Cudweeds	*
<i>Helenium amarum</i> (Raf.) H. Rock	Bitter sneezeweed	HENAM
<i>Ipomoea</i> species	Morningglory species <sup>b</sup>	*
<i>Lamium amplexicaule</i> L.	Henbit	
<i>Lepidium</i> species	Pepperweeds	*
<i>Lolium multiflorum</i> Lam.	Italian ryegrass	LOLMU
<i>Melochia corchorifolia</i> L.	Redweed	MEOCO
<i>Oenothera laciniata</i> Hill.	Cutleaf eveningprimrose	OEOLA
<i>Opuntia</i> species	Cacti	*
<i>Panicum dichotomiflorum</i> Michx.	Fall panicum	PANDI
<i>Panicum texanum</i> Buckl.	Texas panicum	PANTE
<i>Paspalum dilatatum</i> Poir.	Dallisgrass	PASDI
<i>Paspalum notatum</i> Fluegge	Bahiagrass	PASNO
<i>Paspalum urvillei</i> Steud.	Vaseygrass	PASUR
<i>Passiflora incarnata</i> L.	Maypop passionflower	PAQIN
<i>Physalis</i> species	Groundcherries	*
<i>Plantago</i> species	Plantains	*
<i>Polygonum aviculare</i> L.	Prostrate knotweed	POLAV
<i>Polygonum pensylvanicum</i> L.	Pennsylvania smartweed	POLPY
<i>Portulaca</i> species	Purslanes	*
<i>Pueraria lobata</i> (Willd.) Ohwi	Kudzu	PUELO
<i>Ranunculus</i> species	Buttercups	*
<i>Raphanus raphanistrum</i> L.	Wild radish	RAPRA
<i>Richardia scabra</i> L.	Florida pusley	RCHSC
<i>Rosa laevigata</i> Michx.	Cherokee rose	ROSLA
<i>Rubus</i> species	Brambles	*
<i>Rumex acetocella</i> L.	Red sorrel	RUMAA
<i>Rumex crispus</i> L.	Curly dock	RUMCR
<i>Senna obtusifolia</i> (L.) Irwin and Barneby	Sicklepod	CASOB



Table 1. Continued.

Scientific name	Common name	Bayer code
<i>Sesbania exaltata</i> (Raf.) Rydb. Ex A. W. Hill	Hemp sesbania	SEBEX
<i>Setaria</i> species	Foxtails	*
<i>Sida spinosa</i> L.	Prickly sida	SIDSP
<i>Solanum carolinense</i> L.	Horsenettle	SOLCA
<i>Solanum</i> species	Nightshades	*
<i>Sorghum halepense</i> (L.) Pers.	Johnsongrass	SORHA
<i>Sporobolus indicus</i> (L.) R. Br.	Smutgrass	SPZIN
<i>Stachys floridana</i> Shuttlew.	Florida betony	STAFI
<i>Stellaria</i> species	Chickweeds	*
<i>Taraxacum officinale</i> Weber in Wiggers	Dandelion	TAROF
<i>Urtica dioica</i> L.	Stingingnettle	URTDI
<i>Vicia villosa</i> Roth	Hairy vetch	VICVI
<i>Vigna unguiculata</i> (L.) Walpers	Cowpea	VIGSI
<i>Xanthium strumarium</i> L.	Common cocklebur	XANST

<sup>a</sup> \* Indicates a genus, therefore there is no Bayer code.

<sup>b</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemontia tamnifolia*.

within a crop was set to have a relative ranking of 100, and all other species were assigned a value relative to the most troublesome species in each crop.

Elmore (1983) summarized the data from the 1971, 1974, 1977, and 1980 annual SWSS weed surveys and determined the most common weeds across all crops. A similar method was employed in this survey to determine the most troublesome weed species in Georgia, across all the crops surveyed. The relative ranking of each weed was multiplied by the crop acreage. These values were then summed for each weed across all crops.

## RESULTS AND DISCUSSION

**Corn.** Corn hectares in Georgia peaked at 809,000 ha in 1977 and have since steadily declined to about 228,000 ha in 1997.<sup>4</sup> The major corn-growing districts are the three southernmost districts (the Southwestern district [SW], the South-Central district [SC], and the Southeastern district [SE]) and one district along the Atlantic coast in mid-Georgia (the East-Central district [EC]). These districts accounted for 35, 23, 14, and 14% of the state corn hectares, respectively.

Texas panicum was the most troublesome weed listed in the primary corn districts and in two others in the center of the state (the West-Central district [WC] and the Central District [C]) (Table 2). Texas panicum was not listed among the top 10 weed problems in two of the three northern districts (one district did not report). A previous weed summary of the Southern United States indicated that Texas panicum was the third most troublesome weed in corn (Webster and Coble 1997).

Sicklepod was distributed more uniformly throughout the state than Texas panicum, with all the reporting districts listing it among the top 10 most troublesome spe-

cies (Table 2). In two of the four primary corn-producing districts, sicklepod was the second most troublesome weed, a distinction that it also held in the Northwestern district (NW). In the other districts, sicklepod was listed among the top five troublesome weeds. While sicklepod was found in all the reporting districts, it was less troublesome than Texas panicum across the state. The relative ranking was 46% less for sicklepod compared with Texas panicum. Sicklepod was the fifth most troublesome corn weed averaged across all states in the Southern United States (Webster and Coble 1997).

Morningglory species were the third most troublesome weeds in Georgia corn (Table 2). Respondents in the current survey did not consistently separate the morningglory species; therefore, this conglomerate class was created. The morningglory complex included *Ipomoea* species {pitted morningglory (*Ipomoea lacunosa* L.), entireleaf morningglory (*Ipomoea hederacea* var. *integriuscula* Gray), tall morningglory [*Ipomoea purpurea* (L.) Roth.], and cypressvine morningglory (*Ipomoea quamoclit* L.)} and smallflower morningglory [*Jacquemontia tamnifolia* (L.) Griseb.]. Previous surveys of the SWSS indicated that smallflower morningglory was the most troublesome of the morningglory species in Georgia. Morningglory species were the fourth most troublesome corn weed in the Southern United States (Webster and Coble 1997).

Pigweed species were ranked third among the troublesome weeds in EC, fourth in SE and SW, and sixth in SC (Table 2). These species were also important in C (ranked 2) and the North-Central district (NC) (ranked 7) but were not listed among the top 10 in NW and WC. Across the state, pigweed species were the fourth most troublesome corn weed. Pigweed species are becoming

Table 2. The most troublesome weeds in corn in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	Johnsongrass	Johnsongrass	*	Texas panicum	Texas panicum	Texas panicum	Texas panicum	Texas panicum	Texas panicum	Texas panicum (100)
2	Sicklepod	Morningglory species <sup>d</sup>	*	Morningglory species	Pigweed species <sup>e</sup>	Sicklepod	Morningglory species	Sicklepod	Sicklepod	Sicklepod (54)
3	Morningglory species	Fall panicum	*	Johnsongrass	Sicklepod	Pigweed species	Sicklepod	Morningglory species	Morningglory species	Morningglory species (47)
4	Trumpetreepeper	Large crabgrass	*	Nutsedge species <sup>f</sup>	Morningglory species	Nutsedge species	Pigweed species	Pigweed species	Pigweed species	Pigweed species (38)
5	Broadleaf signalgrass	Sicklepod	*	Sicklepod	Broadleaf signalgrass	Morningglory species	Common cocklebur	Pennsylvania smartweed	Nutsedge species (30)	
6	Bermudagrass	Common cocklebur	*	Wild radish	Nutsedge species	Common lambsquarters	Florida beggarweed	Nutsedge species	Common cocklebur (23)	
7	Large crabgrass	Pigweed species	*	Bermudagrass	Bermudagrass	Johnsongrass	Nutsedge species	Common cocklebur	Florida beggarweed (10)	
8	Pennsylvania smartweed	Nutsedge species	*	Common cocklebur	Common cocklebur	Common cocklebur	Large crabgrass	Large crabgrass	Large crabgrass (10)	
9	Fall panicum	Common ragweed	*	Broadleaf signalgrass	Large crabgrass	Tropic croton	Florida pusley	Florida pusley	Johnsongrass (10)	
10	Common cocklebur	Horsenettle	*	Large crabgrass	Johnsongrass	Fall panicum	Common lambsquarters	Johnsongrass	Pennsylvania smartweed (10)	
Corn Area (%)	3	1	1	2	7	14	35	23	14	228,000 ha

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.  
<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.  
<sup>c</sup> \* Indicates a lack of data from counties within this district.  
<sup>d</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemonia tamnifolia*.  
<sup>e</sup> Pigweed species consist of species of *Amaranthus*.  
<sup>f</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).

important weed species throughout the United States, possibly because of the widespread occurrence of herbicide resistant biotypes (e.g., triazine herbicide resistance in Midwestern United States, North Carolina, and Virginia; sulfonyleurea/imidazolinone herbicide resistance in Kentucky, Midwestern United States, and Virginia; and dinitroaniline herbicide resistance in Arkansas and South Carolina) (Heap 1999). To date, there are no documented cases of herbicide-resistant pigweed species in Georgia.

Nutsedge species were the fifth most troublesome weeds in Georgia corn (Table 2). While nutsedge species have historically been difficult to control, there are now herbicides available that control these species in corn (Warren and Coble 1999).

One species noticeably absent from the top five corn weeds in Georgia is johnsongrass. Johnsongrass was the most important species in the two northern districts (NW and NC); however, it is not listed among the top 10 species in the two districts that account for 57% of the corn acreage (SW and SC) (Table 2). Therefore, johnsongrass is listed only as the ninth most important weed in corn throughout Georgia. Johnsongrass was listed as the most troublesome species in Georgia corn in 1974 (Buchanan 1974), but the introduction of herbicides with selective activity on this species in corn (Tweedy and Kapusta 1995) has reduced its importance over time. While it is viewed as only the ninth most troublesome weed in Georgia corn, johnsongrass was still the most troublesome weed in corn throughout the Southern United States (Webster and Coble 1997).

**Cotton.** Georgia ranked second in the United States in both cotton hectares (583,000) and cotton production (1.5 million bales) in 1998.<sup>4</sup> The number of cotton hectares in Georgia peaked in 1910 when it approached 2.1 million ha; however, the number of hectares declined steadily until it reached a low (less than 104,000 ha) in the early 1980s.<sup>5</sup> Since then, cotton hectares and production have rebounded to a fivefold increase. This resurgence in cotton in Georgia has been due in part to the eradication of boll-weevil (*Anthonomus grandis* Boheman), the flexible farm policy, and the introduction of transgenic varieties.<sup>5</sup>

Approximately 80% of Georgia cotton is grown in EC, SC, and SW.<sup>4</sup> The most troublesome cotton weed in these areas (and in seven of the eight reporting districts) was sicklepod (Table 3). The relative rank of sicklepod in Georgia cotton was more than twice the value of the

next closest weed, leaving little doubt that sicklepod was overall the most troublesome weed in cotton in the state. The future importance of this species in Georgia cotton may change due to the recent widespread adoption of glyphosate-tolerant cotton; more than 75% of the cotton hectares in Georgia used this technology in 2000.<sup>6</sup> In spite of the importance of sicklepod in Georgia, averaged across all of the Southern United States, sicklepod was only the seventh most troublesome cotton weed (Webster and Coble 1997).

Pigweed species were the second most troublesome weeds in one of the three primary cotton districts (the third in the other two) and were overall the second most troublesome weeds in cotton (Table 3). As mentioned previously, the importance of pigweed species has increased throughout the United States, possibly due to the occurrence of herbicide-resistant weed biotypes as well as to the changes in the weed management systems. In South Carolina, Palmer amaranth has become the most troublesome weed in cotton due in part to the onset of resistance to the dinitroaniline herbicide family (Dowler 1998; Murdock 1995).

Following sicklepod and pigweed species in the list of most troublesome weeds in cotton are weeds that have near equal rankings. Weeds ranked three through seven (morningglory species, nutsedge species, tropic croton, wild poinsettia [*Euphorbia heterophylla* L.], and bristly starbur [*Acanthospermum hispidum* D.C.]) were tightly clustered with a separation of only 19% (Table 3). Morningglory species were the third most troublesome weeds and listed among the top 10 most troublesome weed species in all the cotton districts (Table 3). Morningglory species were well distributed throughout the Southern United States and were included among the top 10 most troublesome weeds in each of the 11 states participating in the 1995 and 1998 weed surveys of the southern states (Dowler 1995, 1998). Only nutsedge species were as well represented as morningglory species in these regional surveys of cotton weeds. Averaged over all the reporting states, morningglory species were classified as the most troublesome weeds in cotton in the Southern United States (Webster and Coble 1997).

Nutsedge species were the fourth most troublesome weeds in Georgia cotton (Table 3). Nutsedge species are low-growing weeds that typically do not compete with cotton for light, but may compete for water and nutrients. Purple nutsedge densities of 400 shoots/m<sup>2</sup> reduced the yield of irrigated cotton by 50% in North Carolina (T. M. Webster, unpublished data). However, a much

<sup>5</sup> Personal communication. Dr. Steve M. Brown, Extension Cotton Agronomist, University of Georgia, Tifton, GA.

<sup>6</sup> Personal communication. Dr. A. Stanley Culpepper, Extension Cotton Weed Scientist, University of Georgia, Tifton, GA.

Table 3. The most troublesome weeds in cotton in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	Johnsongrass Common cock- lebur	Sicklepod Common cock- lebur	*	Sicklepod Pigweed species	Sicklepod Pigweed species	Sicklepod Nutsedge spe- cies	Sicklepod Pigweed species	Sicklepod Morningglory species <sup>d</sup>	Sicklepod Pigweed species	Sicklepod (100) Pigweed species (48)
2	Sicklepod	Nutsedge spe- cies	*	Tropic croton	Morningglory species	Pigweed spe- cies <sup>e</sup>	Morningglory species	Pigweed species	Nutsedge spe- cies <sup>f</sup>	Morningglory species (40)
3	Bermudagrass	Morningglory species	*	Nutsedge spe- cies	Nutsedge spe- cies	Texas panicum	Florida beggar- weed	Wild poinsettia	Morningglory species	Nutsedge spe- cies (39)
4	Morningglory species	Spiny amaranth	*	Coffee senna	Common cock- lebur	Common cock- lebur	Wild poinsettia	Nutsedge spe- cies	Bristly starbur	Tropic croton (23)
5	Pigweed species	*	*	Morningglory species	Florida beggar- weed	Tropic croton	Nutsedge spe- cies	Tropic croton	Common cock- lebur	Wild poinsettia (23)
6	Velvetleaf	*	*	Common cock- lebur	Texas panicum	Bristly starbur	Bristly starbur	Bristly starbur	Texas panicum	Bristly starbur (21)
7	Nutsedge spe- cies	*	*	Florida beggar- weed	Tropic croton	Prickly sida	Tropic croton	Velvetleaf	Wild poinsettia (17)	Texas panicum
8	*	*	*	Bristly starbur	Coffee senna	Morningglory species	Common cock- lebur	Texas panicum	Tropic croton	Common cock- lebur (15)
9	*	*	*	Johnsongrass	Bermudagrass	Bermudagrass	Texas panicum	Redweed	Redweed	Florida beggar- weed (11)
10										
Cotton Area (%)	1	0	0	2	10	15	27	38	7	583,000 ha

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.  
<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.  
<sup>c</sup> \* Indicates a lack of data from counties within these districts.  
<sup>d</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemonia taminifolia*.  
<sup>e</sup> Pigweed species consist of species of *Amaranthus*.  
<sup>f</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).



lower density of 100 yellow nutsedge shoots/m<sup>2</sup> reduced the nonirrigated cotton yields by more than 50% in Alabama (Patterson et al. 1982). A recent summary of the annual SWSS survey indicated that nutsedge species were the second most troublesome cotton weed species in the Southern United States (Webster and Coble 1997).

The fifth, sixth, and seventh most troublesome species had similar relative rankings (Table 3). Tropic croton (relative rank of 23) was the fifth most troublesome weed and was well distributed throughout Georgia, in all the districts except NW and NC. However, cotton hectares in the northern districts account for less than 1% of the cotton land in Georgia. Croton species were listed as important weeds in four states in the southern region, and throughout the region they were ranked as the 11th most troublesome weed (Webster and Coble 1997). Wild poinsettia (relative ranking of 23) was the sixth most troublesome weed in the state, but it was found only in SW, SC, and SE. However, in SW and SC (66% of Georgia cotton acreage), wild poinsettia was a top-five weed problem. Bristly starbur was distributed in the three southern districts as well as in WC and EC. Only Georgia listed wild poinsettia or bristly starbur as troublesome cotton weeds in the 1995 weed survey of the southern states (Dowler 1995).

**Forages and Pastures.** Production from the 243,000 ha of land in Georgia in forages or pastures was estimated at 1.42 million metric tons of harvested forage in 1997.<sup>4</sup> Unlike many of the other crops, there was no dominant weed in forage crops and pastures across the state (Table 4). The central and southern districts (C, EC, SW, SC, and SE) listed bahiagrass as the dominant weed problem, making it the most troublesome weed in Georgia forages and pastures (relative ranking 100). However, while bahiagrass was found in some of the northern districts, large crabgrass was the most troublesome species in NC, the Northeastern district (NE), and WC. Large crabgrass was the number two species in C, EC, and SC and a top-five species in SW. Large crabgrass was the second most troublesome weed in the state. With a relative rank of 95, it is considered nearly as troublesome as bahiagrass.

Horsenettle (*Solanum carolinense* L.) was widely distributed throughout the state, occurring in every district (Table 4), and was the third most troublesome weed of forages and pastures in Georgia (relative ranking of 83). This creeping perennial weed can be difficult to control once it is established in a pasture. The rhizomes of this species have been documented to reach depths of 3 m (Bassett 1986). Horsenettle is also capable of reproducing through the production of orange berries which con-

tain between 40 and 170 seeds (Bassett 1986). The plant is unpalatable to most animals, and the berries are poisonous; however, it will be grazed when food is scarce.

Johnsongrass (relative ranking of 73) was the fourth most troublesome weed in Georgia forages and pastures (Table 4). It was a top-five weed in all the districts, except in SE and SC where it was the 7th and 14th (data not shown) most troublesome forage and pasture weed, respectively. Johnsongrass was reportedly introduced into Alabama in 1840 by Colonel William Johnson as a forage crop (Mitich 1987). While johnsongrass has a protein content similar to alfalfa (*Medicago sativa* L.) and a feeding value similar to timothy (*Phleum pratense* L.), under drought stress it produces prussic acid which can be fatal to livestock (McWhorter 1989).

The final complex of plants that comprise the top five most troublesome weeds in forage and pastures were thistle species (relative ranking of 53) (Table 4). The most common thistle species in Georgia were bull thistle and musk thistle. These thistle species were introduced from Europe, and both species are monocarpic perennials. Bull thistle is so well distributed throughout the world that it can be found in every continent except for Antarctica (Forcella and Randall 1994). While neither species is reported to be toxic to livestock, the thorny leaves and stems can deter grazing and reduce livestock weight gain (Forcella and Randall 1994).

**Peanut.** Georgia was the leading peanut-producing state in the United States in 1997 with approximately 210,500 ha of peanut grown.<sup>4</sup> Greater than 80% of the peanut hectares are in SW and SC (Table 5). All other districts had 8% or less of the total peanut hectares, while peanuts are not grown in the three northern districts. Florida beggarweed was the most troublesome peanut weed in Georgia with a relative ranking 31 points higher than the second-ranked weed (Table 5). All districts except WC and C (these two districts accounted for just 10% of the hectares) reported that Florida beggarweed was the most troublesome peanut weed. A summary of the 1995 SWSS weed survey indicated that Florida beggarweed was the second most troublesome weed in peanut, a distinction that it also held in 1983 (Dowler 1995; Elmore 1983; Webster and Coble 1997).

Nutsedge species (relative ranking of 69) were the second most troublesome weed species in Georgia peanut (Table 5). In each of the peanut districts, nutsedge species were listed as either the number one or the number two most troublesome species in peanut. These low-growing weeds cause losses due to competition for resources and also cause problems with contamination at

Table 4. The most troublesome weeds in forages and pastures in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	Johnsongrass	Large crabgrass	Large crabgrass	Large crabgrass	Bahiagrass	Bahiagrass	Bahiagrass	Bahiagrass	Bahiagrass	Bahiagrass (100)
2	Buttercup species <sup>c</sup>	Thistle species	Horsenettle	Horsenettle	Large crabgrass	Large crabgrass	Horsenettle	Large crabgrass	Dogfennel	Large crabgrass (95)
3	Large crabgrass	Horsenettle	Thistle species	Johnsongrass	Horsenettle	Johnsongrass	Johnsongrass	Vaseygrass	Horsenettle	Horsenettle (83)
4	Horsenettle	Johnsongrass	Bahiagrass	Bahiagrass	Johnsongrass	Cacti	Italian ryegrass	Dogfennel	Vaseygrass	Johnsongrass (73)
5	Pigweed species <sup>d</sup>	Spiny amaranth	Johnsongrass	Brambles <sup>e</sup>	Thistle species	Horsenettle	Large crabgrass	Curly dock	Sandbur species <sup>f</sup>	Thistle species (53)
6	Bitter sneeze-weed	Foxtail species <sup>g</sup>	Nutsedge species <sup>h</sup>	Thistle species <sup>i</sup>	Pigweed species <sup>j</sup>	Sandbur species	Thistle species	Smutgrass	Goosegrass	Pigweed species (26)
7	Common bermudagrass	Dallisgrass	Pigweed species <sup>k</sup>	Foxtail species	Cherokee rose	Thistle species	Smutgrass	Horsenettle	Johnsongrass	Vaseygrass (23)
8	Thistle species	Buttercup species <sup>l</sup>	Fall panicum	Pigweed species <sup>m</sup>	Sandbur species	Pigweed species <sup>n</sup>	Vaseygrass	Thistle species	Chamomile species <sup>o</sup>	Dogfennel (22)
9	Chickweed species <sup>p</sup>	Bahiagrass	Foxtail species	Curly dock	Bitter sneeze-weed	Texas panicum	Brambles	Pigweed species <sup>q</sup>	Thistle species	Sandburs (21)
10	Dogfennel	Broomsedge	* <sup>1</sup>	Common rag-weed	Cacti <sup>m</sup>	Wild radish	Dogfennel	Stinging nettle	Bitter sneeze-weed	Brambles (21)

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.

<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.

<sup>c</sup> Buttercup species consist of *Ranunculus* species.

<sup>d</sup> Pigweed species consist of species of *Amaranthus*.

<sup>e</sup> Bramble species consist of *Rubus* species.

<sup>f</sup> Sandbur species consist of *Cenchrus* species.

<sup>g</sup> Foxtail species consist of *Setaria* species.

<sup>h</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).

<sup>i</sup> Thistle species include *Cirsium vulgare* and *Carduus nutans*.

<sup>j</sup> Chamomile species consist of *Anthemis* species.

<sup>k</sup> Chickweed species consist of *Stellaria* species.

<sup>l</sup> \* Indicates a lack of data from counties within this district.

<sup>m</sup> Cacti consist of *Opuntia* species.

Table 5. The most troublesome weeds in peanut in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	*	*	*	Nutsedge species <sup>d</sup>	Nutsedge species	Florida beggar-weed	Florida beggar-weed	Florida beggar-weed	Florida beggar-weed	Florida beggar-weed (100)
2	*	*	*	Florida beggar-weed	Sicklepod	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species (69)
3	*	*	*	Texas panicum	Florida beggar-weed	Bristly starbur	Tropic croton	Tropic croton	Texas panicum	Tropic croton (47)
4	*	*	*	Prickly sida	Tropic croton	Sicklepod	Texas panicum	Sicklepod	Sicklepod	Sicklepod (41)
5	*	*	*	Tropic croton	Texas panicum	Tropic croton	Sicklepod	Bristly starbur	Morningglory species <sup>e</sup>	Texas panicum (31)
6	*	*	*	Sicklepod	Morningglory species	Texas panicum	Morningglory species	Wild poinsettia	Bristly starbur	Bristly starbur (26)
7	*	*	*	Bristly starbur	Pigweed species <sup>f</sup>	Pigweed species	Bristly starbur	Texas panicum	Tropic croton	Morningglory species (20)
8	*	*	*	Florida pusley	Large crabgrass	Citronmelon	Citronmelon	Burgherkin	Burgherkin	Wild poinsettia (13)
9	*	*	*	Showy crotalaria	Prickly sida	Morningglory species	Wild poinsettia	Morningglory species	*	Citronmelon (10)
10	*	*	*	*	Horsenettle	Common lambs-quarters	Hophornbeam copperleaf	Eclipta	*	Pigweed species (9)
Peanut area (%)	0	0	0	2	8	8	45	36	1	210,500 ha

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.

<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.

<sup>c</sup> \* Indicates a lack of data from counties within these districts.

<sup>d</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).

<sup>e</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemontia tammifolia*.

<sup>f</sup> Pigweed species consist of species of *Amaranthus*.

harvest due to the tubers of the nutsedge species. A density of six yellow nutsedge shoots/m<sup>2</sup> reduced peanut yields by 5% (Johnson III 1999). Nutsedge species have been previously described as the most troublesome peanut weed in the Southern United States (Webster and Coble 1997).

Tropic croton (relative ranking of 47) and sicklepod (relative ranking of 41) were the third and fourth most troublesome weeds in Georgia peanut (Table 5). Sicklepod is an important weed throughout the southeastern coastal plain, with a top-five ranking in Alabama, Florida, Georgia, North Carolina, and South Carolina in peanut (Dowler 1998). A survey of weed specialists throughout the United States found that the range of sicklepod extends north from Florida to Kentucky and Virginia and west from the Atlantic coast to Oklahoma and Texas (Teem et al. 1980). With the exception of Kentucky, all the states within its distribution listed sicklepod as an increasing weed problem (Teem et al. 1980).

The fifth and sixth most troublesome peanut weeds were Texas panicum and bristly starbur, two species that were relatively well distributed throughout the Georgia peanut-growing region (Table 5). Texas panicum (relative ranking of 31) was ranked between the third and the seventh most troublesome weed species in each of the districts. The importance of Texas panicum between 1974 and 1995 remained steady at the number 10 among the most troublesome peanut weeds in the Southern United States (Webster and Coble 1997). Bristly starbur (relative ranking of 26) was found in all the peanut-growing areas except Central Georgia (C), and was ranked in the other peanut-growing districts between the third and seventh positions. Bristly starbur was listed as a troublesome peanut weed in three states (Alabama, Florida, and Georgia) in 1995 and was among the weed species that increased in importance in the Southern United States between 1974 and 1995 (Dowler 1995; Webster and Coble 1997).

Morningglory species were the seventh most troublesome peanut weeds in Georgia. Morningglory species were listed as important species in all the peanut-producing districts except WC; however, their highest ranking within a district was fifth (Table 5). In the two primary peanut districts (SW and SC), morningglory species were the sixth and ninth most troublesome weed species. A previous survey of the peanut-growing states indicated that smallflower morningglory was the fifth and pitted morningglory the ninth most troublesome weed in peanut in Georgia (Wilcut et al. 1994).

Wild poinsettia has long been recognized as an im-

portant species in Louisiana, but has only recently become a problem in Georgia (Bridges et al. 1992). It was estimated that wild poinsettia had been in southwest Georgia since the early 1980s and that its distribution increased significantly in the late 1980s to early 1990s (Bridges et al. 1992). Wild poinsettia was ranked as the eighth most troublesome peanut weed in Georgia, but it was found only in SW and SC (Table 5). In fact, only eight counties in Georgia (Calhoun, Coffee, Cook, Dooly, Dougherty, Early, Mitchell, and Webster) listed this species among the top five weeds in peanut, but these counties account for 22% of the peanut hectares. In the 1995 SWSS weed survey, only Georgia listed wild poinsettia as a troublesome peanut weed (Dowler 1995). In 1998 Alabama also included this species as a troublesome peanut weed (Dowler 1998).

Citronmelon [*Citrullus lanatus* var. *citroides* (Bailey) Mansf.] and pigweed species were the 9th and 10th most troublesome weeds of peanut, respectively (Table 5). Citronmelon was not listed as a troublesome weed in the Southern United States peanut production (Webster and Coble 1997). In the Southern United States, pigweed species were the third most troublesome peanut weeds in 1995 and the second most troublesome in 1974 (Webster and Coble 1997). However, while pigweed species were listed as a common species in Georgia peanut in the 1998 SWSS survey, they were not listed among the 10 most troublesome species (Dowler 1998).

**Small Grains.** A combination of wheat (162,000 ha), rye (121,000 ha), and oat (28,000 ha) comprise the small grains component of this survey.<sup>4</sup> All these crops are cool-season grasses with similar weed management tools and weed problems. The districts with the largest hectares in small grains were C, EC, SC, and SW, which together had 84% of the Georgia small grain hectares (Table 6). The two top-ranking weed problems in Georgia small grains were wild radish (relative ranking of 100) and Italian ryegrass (*Lolium multiflorum* Lam.) (relative ranking of 65). With the exception of NW and NC (where it was the third most troublesome weed), wild radish was the most troublesome weed in all the reporting districts. Italian ryegrass was the second most troublesome species in all the other districts, with the exception of SE where it was the third most troublesome species. Both wild radish and Italian ryegrass are winter annuals which germinate in the fall or in early spring and complete their life cycle before summer. The occurrence of Italian ryegrass resistance to diclofop was reported in Georgia in 1995 (Heap 1999), perhaps contrib-

Table 6. The most troublesome weeds in small grains in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	Italian ryegrass	Italian ryegrass	*	Wild radish	Wild radish	Wild radish	Wild radish	Wild radish	Wild radish	Wild radish (100)
2	<i>Allium</i> species <sup>d</sup>	<i>Allium</i> species	*	Italian ryegrass	Italian ryegrass	Italian ryegrass	Italian ryegrass	Italian ryegrass	Carolina geranium	Italian ryegrass (65)
3	Wild radish	Wild radish	*	Curly dock	<i>Allium</i> species	<i>Allium</i> species	Cutleaf evening-primrose	Carolina geranium	Italian ryegrass	<i>Allium</i> species (16)
4	Hairy vetch	*	*	<i>Allium</i> species	Henbit	Henbit	Common ragweed	Cutleaf evening-primrose	Cutleaf evening-primrose	Cutleaf evening-primrose (13)
5	Thistle species <sup>e</sup>	*	*	Thistles	Cutleaf evening-primrose	Plantain species <sup>f</sup>	Curly dock	Swinecress	Swinecress	Henbit (9)
6	Shepherdspurse	*	*	Cutleaf evening-primrose	Curly dock	Carolina geranium	<i>Allium</i> species	<i>Allium</i> species	Florida pusley	Carolina geranium (7)
7	Dandelion	*	*	Johnsongrass	Carolina geranium	Cutleaf evening-primrose	Cudweed species <sup>g</sup>	Henbit	Shepherdspurse	Curly dock (4)
8	Pigweed species <sup>h</sup>	*	*	Fall panicum	Chickweed species <sup>i</sup>	Bristly starbur	Common lambsquarters	Common ragweed	Florida betony	Common ragweed (4)
9	Curly dock	*	*	Corn cockle	Common ragweed	Wild poinsettia	Carolina geranium	Red sorrel	Dandelion	Swinecress (3)
10	*	*	*	Velvetleaf	Corn cockle	Swinecress	Henbit	Plantain species	Pepperweed species <sup>j</sup>	Plantain species (2)
Crop area (%)	1	1	0	6	20	18	30	16	4	311,000 ha

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.

<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.

<sup>c</sup> \* Indicates a lack of data from counties within these districts.

<sup>d</sup> *Allium* species consist of wild onion (*Allium canadense* L.) and wild garlic (*Allium vineale* L.).

<sup>e</sup> Thistle species include *Cirsium vulgare* and *Carduus nutans*.

<sup>f</sup> Plantain species consist of *Plantago* species.

<sup>g</sup> Cudweed species consist of *Gnaphalium* species.

<sup>h</sup> Pigweed species consist of species of *Amaranthus*.

<sup>i</sup> Chickweed species consist of *Stellaria* species.

<sup>j</sup> Pepperweed species consist of *Lepidium* species.



uting to the importance of Italian ryegrass as a weed in small grains.

Following these top-two species, the relative importance of the weeds declines rapidly; the third most troublesome species, *Allium* species, had a relative ranking of 16 (Table 6). Cutleaf eveningprimrose (*Oenothera lacinata* Hill), henbit (*Lamium amplexicaule* L.), Carolina geranium (*Geranium carolinianum* L.), curly dock (*Rumex crispus* L.), common ragweed (*Ambrosia artemisiifolia* L.), swinecress [*Coronopus didymus* (L.) Sm.], and plantain species were the 4th through 10th most troublesome weed species in small grain with relative rankings ranging from 2 to 13. With the exception of curly dock (simple perennial) and common ragweed (early-emerging summer annual), all 10 of the troublesome weeds of small grains have the ability to exist as winter annuals.

**Soybean.** Approximately 173,000 ha of soybean were grown in Georgia in 1997.<sup>4</sup> The primary soybean-growing areas were C, EC, and SW with 64% of the hectares (Table 7). Sicklepod (relative ranking of 100) was clearly the most troublesome weed in these districts and across the state. Sicklepod is a hard-seeded legume which has a similar growth habit to soybean and, prior to the introduction of transgenic crops, was difficult to control selectively. Between 1974 and 1995, sicklepod was the weed with the highest rate of increase as a troublesome weed in soybean in the southern region (Webster and Coble 1997). Sicklepod was ranked as the most troublesome soybean weed throughout the southern region and was only one of the four species listed as a troublesome weed in 10 of the 11 soybean-growing states (Dowler 1995; Webster and Coble 1997).

Morningglory species (relative ranking of 49) were the second most troublesome weed of soybean in Georgia (Table 7). They ranked second in SE and SW and third in C and SC, and were also among the top 10 weeds of all other districts that had greater than 5% of the Georgia soybean hectares. Across the Southern United States, morningglory species were ranked as the second most troublesome soybean weed in 1995 and were the most troublesome species in 1983 (Elmore 1984; Webster and Coble 1997).

Pigweed species (relative ranking of 45) and nutsedge species (relative ranking of 30) were the third and fourth most troublesome soybean weeds in Georgia, respectively (Table 7). Pigweed species were ranked as the second most troublesome weed species in C, SC, and EC. In C, Palmer amaranth was also listed as the ninth most troublesome species. Nutsedge species were among the top 10 most troublesome weeds in all districts with 5% or

more of the state soybean hectares. Nutsedge species are low-growing plants which can compete with young soybean plants for moisture and nutrients and can be difficult to control.

Some of the weeds which had a differential spatial distribution in the state were Texas panicum, Florida beggarweed, and bristly starbur (Table 7). Texas panicum (relative ranking of 28) ranged from the 3rd to the 11th (data not shown) most troublesome soybean weed in all but the three northern districts (NW, NC, and NE), and was the fifth most troublesome weed in Georgia soybean. Florida beggarweed (relative ranking of 19) was the seventh most troublesome soybean weed, but it was localized in the southern part of the state and was listed as a top-10 weed in central Georgia (C) and in the three southern districts (SW, SC, and SE). Bristly starbur (relative ranking of 14), the eighth most troublesome soybean weed in Georgia, was found in the southern part of the state (SC, SE, and SW) and along the Atlantic coast (EC). In contrast to these three weeds is common cocklebur (relative ranking of 22), the sixth most troublesome weed in soybean and a top 10 weed in all but one of the reporting districts (C) (Table 7).

The 9th and 10th most troublesome weeds of soybean were common bermudagrass [*Cynodon dactylon* (L.) Pers.] and coffee senna (*Cassia occidentalis* L.) (Table 7). Common bermudagrass (relative ranking of 10) was listed as a troublesome soybean weed in NW, WC, and SC, and was not listed as a top-10 weed in districts with greater than 11% of the soybean hectares. Coffee senna (relative ranking of 7) was found in the southern and western part of the state (SW, WC, and SC). A survey published in 1980 indicated that coffee senna was a problem weed in Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina, and was listed as an increasing weed problem in all these states except Florida (Teem et al. 1980).

**Tobacco.** Georgia was the third largest producer of flue-cured tobacco in 1997 with approximately 17,500 ha, all within C, EC, SW, SC, and SE.<sup>4</sup> The primary tobacco growing district was SC with 53% of the state's hectares. The most troublesome tobacco weed complex in all the districts were the nutsedge species (Table 8). Nutsedge species cause the most problems to young tobacco plants as they compete for water and nutrients.

The second and third most troublesome weeds in tobacco were Florida beggarweed (relative ranking of 43) and sicklepod (relative ranking of 36) (Table 8). Florida beggarweed was the number two weed in EC and SC and a top-five weed in SW and SE. Sicklepod was a top-

Table 7. The most troublesome weeds in soybean in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	Sicklepod Johnsongrass	Sicklepod Common cock- lebur	**	Sicklepod Coffee senna	Sicklepod Pigweed spe- cies <sup>d</sup>	Sicklepod Pigweed spe- cies <sup>e</sup>	Sicklepod Morningglory species <sup>f</sup>	Sicklepod Pigweed species	Sicklepod Morningglory species	Sicklepod (100) Morningglory species (49)
2	Common cock- lebur	Johnsongrass	*	Tropic croton	Morningglory species <sup>d</sup>	Morningglory species <sup>e</sup>	Texas panicum	Morningglory species	Texas panicum	Pigweed species (45)
3	Morningglory species	Nutsedge spe- cies	*	Common ber- mudagrass	Nutsedge spe- cies	Texas panicum	Nutsedge spe- cies	Florida beggar- weed	Pigweed species	Nutsedge spe- cies (30)
4	Pigweed species	*	*	Nutsedge spe- cies	Texas panicum	Common cock- lebur	Florida beggar- weed	Common cock- lebur	Nutsedge spe- cies	Texas panicum (28)
5	Common rag- weed	*	*	Pigweed species	Common cock- lebur	Morningglory species	Bristly starbur	Common ber- mudagrass	Common cock- lebur	Common cock- lebur (22)
6	Common ber- mudagrass	*	*	Morningglory species	Florida beggar- weed	Cowpea	Pigweed species	Bristly starbur	Tropic croton	Florida beggar- weed (19)
7	Nutsedge spe- cies	*	*	Texas panicum	Large crabgrass	Bristly starbur	Common cock- lebur	Common ber- mudagrass	Florida beggar- weed	Bristly starbur (14)
8	*	*	*	Common rag- weed	Palmer ama- ranth	Johnsongrass	Wild poinsettia	Redweed	Pennsylvania smartweed	Common ber- mudagrass (10)
9	*	*	*	Palmer ama- ranth	Coffee senna	Tropic croton	Coffee senna	Wild poinsettia	Bristly starbur	Coffee senna (7)
10	*	*	*	Palmer ama- ranth	Coffee senna	Tropic croton	Coffee senna	Wild poinsettia	Bristly starbur	Coffee senna (7)
Crop area (%)	5	1	0	6	20	26	18	11	11	173,000 ha

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.

<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.

<sup>c</sup> \* Indicates a lack of data from counties within these districts.

<sup>d</sup> Pigweed species consist of species of *Amaranthus*.

<sup>e</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemontia taminifolia*.

<sup>f</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).

Table 8. The most troublesome weeds in tobacco in the nine climatological districts of Georgia.

Rank	District									Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE	
1	*	*	*	*	Nutsedge species <sup>d</sup>	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species (100)
2	*	*	*	*	Sicklepod	Florida beggarweed	Sicklepod	Florida beggarweed	Sicklepod	Florida beggarweed (43)
3	*	*	*	*	Common cocklebur Pigweed species	Texas panicum Bristly starbur	Florida beggarweed Morningglory species <sup>f</sup>	Sicklepod Morningglory species	Pigweed species <sup>e</sup> Texas panicum	Sicklepod (36) Pigweed species (24)
5	*	*	*	*	Morningglory species	Pigweed species Italian ryegrass	*	Common cocklebur Pigweed species	Florida beggarweed Bristly starbur	Texas panicum (24) Morningglory species (17)
6	*	*	*	*	*	*	*	Texas panicum	Prickly sida	Common cocklebur (17)
7	*	*	*	*	*	Common bermuda-grass	*	Texas panicum	Prickly sida	Common cocklebur (17)
8	*	*	*	*	*	Large crabgrass	*	Citronmelon Coffee senna	Common cocklebur Citron	Citron (12) Bristly starbur (8)
9	*	*	*	*	*	Common cocklebur	*	Coffee senna Burgherkin	Fall panicum	Coffee senna (7)
10	*	*	*	*	*	Johnsongrass	*	Burgherkin	27	17,500 ha
Acre (%)	0	0	0	0	4	9	7	53	27	

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.

<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.

<sup>c</sup> \* Indicates a lack of data from counties within these districts.

<sup>d</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).

<sup>e</sup> Pigweed species consist of *Amaranthus* species.

<sup>f</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemontia tamnifolia*.

three weed in all but the EC (9% of the tobacco hectares).

Pigweed species (relative ranking of 24) and Texas panicum (relative ranking of 24) were the fourth and fifth most troublesome species in Georgia tobacco (Table 8). Pigweed species were listed among the top six most troublesome weeds in all districts except SW (7% of the tobacco hectares).

**Vegetables.** There are more than 30 vegetable crops grown in Georgia.<sup>7</sup> The diversity in the culture of these crops makes the evaluation of weed species difficult. These crops can be grown in the spring, summer, and fall, with the possibility of three crops being grown on the same land in one year. Some crops are grown from transplants, others are direct-seeded into the field. Some crops are grown using a plasticulture system, while others are grown on bare soil. Some crops are grown with irrigation, others are grown with no supplemental water. Because of the diversity of the vegetable crops, care must be taken when interpreting the results of this survey.

The distribution of vegetables in Georgia is highly skewed toward the southern portion of the state; the three southern districts (SW, SC, and SE) account for more than 80% of the vegetable hectares in the state.<sup>7</sup> With approximately 32,000 ha, SC accounts for 45% of the total vegetable hectares in Georgia.<sup>7</sup>

The most troublesome weed species complex in vegetables in Georgia were the nutsedge species (relative ranking of 100) (Table 9). All the districts with greater than 2% of the total vegetable hectares listed nutsedge species as the most troublesome weed. Nutsedge species are low-growing plants that compete with these crops for water and soil nutrients and often contaminate the leafy vegetables. Nutsedge species have also been shown to have a negative effect on vegetable growth due to the release of allelopathic compounds (Dhillon et al. 1993; Gilreath 1981; Meissner et al. 1982). The introduction of plasticulture has helped to minimize the importance of many vegetable weeds. Nutsedge species, however, are capable of piercing this barrier and emerging to continue to compete with the crops.

The second most troublesome weeds in Georgia vegetables were the pigweed species (relative ranking of 47) (Table 9). All the reporting districts, with the exception of EC, listed pigweed species among the top five most troublesome weeds. Sicklepod (relative ranking of 42) was the third most troublesome vegetable weed in the

state and was listed among the top 10 weeds in each of the reporting districts.

Swinecress was the number four most troublesome species in Georgia vegetables (relative ranking of 24), but it was a problem only in SC and SE (59% of the vegetable hectares) (Table 9). Many of the remaining weed species in the top 10 across the state were highly influenced by the southern districts. Cutleaf evening-primrose (relative ranking of 20) was only found in the southern districts (SW, SC, and SE), as was bristly starbur (relative ranking of 14) and Florida beggarweed (relative ranking of 9). Texas panicum was a problem weed in all but the northern districts (NW, NC, and NE), and was the eighth most troublesome weed (relative ranking of 13).

**The Most Troublesome Weeds in Georgia.** Of the top 10 most troublesome weeds in Georgia, five of them can be classified as large-seeded (over 1 mm in diameter) annual broadleaf weeds, one as a small-seeded (less than 1 mm in diameter) annual broadleaf weed (pigweed species), two as annual grasses (Texas panicum and large crabgrass), one as a perennial grass (bahia grass), and one as a perennial sedge (nutsedge species). Summed across all the crops surveyed, the most troublesome weed species in Georgia was sicklepod (Table 10). Sicklepod (total relative ranking of 100) was the most troublesome weed in cotton and soybean and a top-four weed in corn, peanut, tobacco, and vegetables. Sicklepod was listed as a troublesome weed in all the crops surveyed. This ranking was heavily weighted by cotton due to its wide distribution across the state relative to the other crops surveyed. Sicklepod seeds have a hard seed coat that allows them to persist in the seedbank and are capable of season-long emergence, making this weed difficult to control in a multitude of crops.

Nutsedge species (total relative ranking of 59) and pigweed species (total relative ranking of 56) were the second and third most troublesome weeds averaged over all crops (Table 10). Nutsedge species were the most troublesome species in tobacco and vegetables and among the top five most troublesome species in corn, cotton, peanut, and soybean. Pigweed species were found in all the crops surveyed and were the second most troublesome weeds of cotton and vegetables. In addition, pigweed species were among the 10 most troublesome weed species in corn, forages and pastures, peanut, soybean, and tobacco.

Morningglory species and Texas panicum were the fourth and fifth most troublesome species in Georgia averaged over all crops (Table 10). Morningglory species

<sup>7</sup> State and County Vegetable Acreage Estimates 1996. Cooperative Extension/University of Georgia. Ag Econ 93-027-A.

Table 9. The most troublesome weeds in vegetables in the nine climatological districts of Georgia.

Rank	District										Total <sup>b</sup>
	NW <sup>a</sup>	NC	NE	WC	C	EC	SW	SC	SE		
1	* <sup>c</sup>	Large crabgrass	*	Nutsedge species <sup>d</sup>	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species	Nutsedge species (100)	
2	*	Pigweed species <sup>e</sup>	*	Pigweed species	Pigweed species	Texas panicum	Bristly starbur	Pigweed species	Sicklepod	Pigweed species (47)	
3	*	Pennsylvania smartweed	*	Sicklepod	Sicklepod	Sicklepod	Pigweed species	Pigweed species	Sicklepod	Sicklepod (42)	
4	*	Johnsongrass	*	Wild radish	Large crabgrass	Tropic croton	Sicklepod	Swinecress	Swinecress	Swinecress (24)	
5	*	Common cocklebur	*	Morningglory species <sup>f</sup>	Texas panicum	Florida pusley	Wild radish	Cutleaf evening-primrose	Cutleaf evening-primrose	Cutleaf evening-primrose (20)	
6	*	Groundcherry species <sup>g</sup>	*	Large crabgrass	Morningglory species	*	Pennsylvania smartweed	Wild radish	Wild radish	Wild radish (19)	
7	*	Sicklepod	*	Johnsongrass	Bermudagrass	*	Texas panicum	Texas panicum	Texas panicum	Bristly starbur (14)	
8	*	Spurge species <sup>h</sup>	*	Bermudagrass	*	*	Prickly sida	Florida beggarweed	Florida pusley	Texas panicum (13)	
9	*	*	*	Texas panicum	*	*	Johnsongrass	Tropic croton	Florida beggarweed	Florida beggarweed (9)	
10	*	*	*	Florida beggarweed	*	*	Cutleaf evening-primrose	Coffee senna	Common cocklebur	Tropic croton (6)	
Crop area (%)	0	2	1	5	9	2	22	45	14	72,600 ha	

<sup>a</sup> For a description of the location of the districts, see the "Materials and Methods" section.  
<sup>b</sup> The relative rank of the weed is in parentheses, signifying the relative importance of each weed species.  
<sup>c</sup> \* Indicates a lack of data from counties within these districts.  
<sup>d</sup> Nutsedge species include yellow nutsedge (*Cyperus esculentus*) and purple nutsedge (*Cyperus rotundus*).  
<sup>e</sup> Pigweed species consist of *Amaranthus* species.  
<sup>f</sup> The generic morningglory species includes *Ipomoea* spp. and *Jacquemontia tamnifolia*.  
<sup>g</sup> Groundcherry species consist of *Physalis* species.  
<sup>h</sup> Spurge species consist of *Euphorbia* species.



Table 10. The most troublesome weeds in Georgia averaged across all the crops surveyed (corn, cotton, forages and pastures, peanut, small grains, soybean, tobacco, and vegetables).

Rank	Weed species <sup>a</sup>	Total relative ranking <sup>b</sup>	No. of crops
1	Sicklepod	100	8
2	Nutsedge species	59	7
3	Pigweed species	56	8
4	Morningglory species	46	6
5	Texas panicum	45	8
6	Florida beggarweed	34	7
7	Wild radish	31	3
8	Large crabgrass	28	7
9	Tropic croton	25	7
10	Bahiagrass	24	1
11	Italian ryegrass	24	4
12	Bristly starbur	22	7
13	Johnsongrass	22	7
14	Horsenettle	22	5
15	Common cocklebur	18	8
16	Wild poinsettia	17	5
17	Thistle species	14	2
18	Common bermudagrass	8	8
19	Vaseygrass	6	1
20	Cutleaf eveningprimrose	5	2
21	Allium species	5	2
22	Dogfennel	5	1
23	Sandbur species	5	2
24	Brambles	5	1
25	Citronmelon	5	6
26	Spiny amaranth	5	3
27	Curly dock	5	2
28	Common ragweed	5	7
29	Smutgrass	4	1
30	Redweed	4	3
31	Bitter sneezeweed	4	1
32	Prickly sida	4	7
33	Buttercup species	4	1
34	Velvetleaf	3	2
35	Cacti	3	1
36	Foxtail species	3	1
37	Henbit	3	1
38	Coffee senna	3	6
39	Dayflower species	3	4
40	Florida pusley	2	7
41	Swinecress	2	2
42	Pennsylvannia smartweed	2	4
43	Dallisgrass	2	1
44	Cowpea	2	2
45	Burgherkin	2	6
46	Carolina geranium	2	1
47	Broadleaf signalgrass	2	2
48	Eclipta	2	2
49	Broomsedge	2	1
50	Stinging nettle	2	1
51	Fall panicum	2	4
52	Common lambsquarters	1	6
53	Hophornbeam copperleaf	1	2
54	Palmer amaranth	1	3
55	Cherokee rose	1	1
56	Chickweed species	1	2
57	Red sorrel	1	2
58	Plantain species	1	2
59	Peanut	1	2
60	Hemp sesbania	1	2
61	Goosegrass	1	2
62	Dandelion	1	2
63	Spiderflower	1	2
64	Chamomile species	1	1
65	Kudzu	0	1

Table 10. Continued.

Rank	Weed species <sup>a</sup>	Total relative ranking <sup>b</sup>	No. of crops
66	Maypop passionflower	0	1
67	Persimmon	0	1
68	Nightshade species	0	1
69	Trumpet creeper	0	1
70	Cudweed species	0	1
71	Fescue species	0	1
72	Horseweed	0	1
73	Showy croatalaria	0	3
74	Shepherdspurse	0	1
75	Florida betony	0	1
76	Corn cockle	0	1
77	Spurge species	0	2
78	Hairy vetch	0	1
79	Pepperweed species	0	1
80	Purslane species	0	1
81	Annual sedge	0	1
82	Prostrate knotweed	0	1
83	Groundcherry species	0	1

<sup>a</sup> Scientific names for these species can be found in Table 1.

<sup>b</sup> The total relative ranking for each weed species is composed of the product of the relative ranking and the crop acreage, summed over all eight crops.

were among the top three most troublesome weeds in corn, cotton, and soybean and the top 10 weeds in peanut and tobacco. Though an important complex of species, morningglory species were not dominant weeds in any particular crop. The most troublesome weed in corn, Texas panicum, was also a top-five weed in peanut, soybean, and tobacco, and a top-10 weed in cotton and vegetables. Texas panicum was found in all the crops surveyed.

Florida beggarweed was sixth most troublesome weed in Georgia and was listed as a problem weed in all but one of the crops surveyed (small grains) (Table 10). Florida beggarweed was the most troublesome weed in peanut, the second most troublesome weed in tobacco, and a top-10 weed in corn, cotton, soybean, and vegetables. Both Texas panicum and Florida beggarweed appeared to be more prevalent in southern Georgia.

Wild radish and large crabgrass were the seventh and eighth most troublesome weeds in Georgia (Table 10). Wild radish was a troublesome weed of three crops. The high overall ranking of this weed is primarily due to its distinction as the most troublesome small grain weed and the sixth most troublesome vegetable weed. Large crabgrass was the second most troublesome weed in forage and pastures and was reported in six of the other seven crops surveyed. Large crabgrass was the eighth most troublesome weed in corn and a top-25 species in peanut, soybean, tobacco, and vegetables (data not shown).

Tropic croton and bahiagrass were the 9th and 10th most troublesome weeds in Georgia, respectively (Table 10). Tropic croton was a weed in seven of the eight crops

surveyed and was the 3rd, 5th, and 10th most troublesome weed in peanut, cotton, and vegetables, respectively. Bahiagrass was the most troublesome weed in forages and pastures and was not listed as a weed in any other crop.

Some of the other notable weeds among the 20 most important in Georgia with multiple crop distributions were bristly starbur (ranked 12, reported in seven crops), johnsongrass (ranked 13, reported in seven crops), common cocklebur (ranked 15, reported in eight crops), wild poinsettia (ranked 16, reported in five crops), and common bermudagrass (ranked 18, reported in eight crops). Other species listed in six or more crops included common ragweed (ranked 28, reported in seven crops), prickly sida (*Sida spinosa* L.) (ranked 32, reported in seven crops), coffee senna (ranked 38, reported in six crops), Florida pusley (*Richardia scabra* L.) (ranked 40, reported in seven crops), burgherkin (*Cucumis anguria* L.) (ranked 45, reported in six crops), and common lambsquarters (*Chenopodium album* L.) (ranked 52, reported in six crops) (Table 10). All other weeds in the survey were listed as troublesome weeds in four or fewer crops.

This survey has identified the primary weeds in eight crops in each of the nine climatological districts in Georgia. This information should help county and state extension personnel develop extension and research programs that address troublesome weed problems within cropping systems in the various regions of Georgia.

### ACKNOWLEDGMENTS

The authors thank each of the county extension agents for completing this survey and supplying a database of the distribution of the important weed species in Georgia. We also thank Drs. W. C. Johnson, A. W. Johnson, A. S. Culpepper, E. P. Prostko, J. A. Baldwin, D. Lee, and D. C. Bridges for their critical review of this manuscript.

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