

**UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION
SERVICE**

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Project Title: Integrated methods for sustainable control of glyphosate-resistant horseweed (*Conyza canadensis*) and other problematic winter weeds.

Key Words: Horseweed, glyphosate resistance, cover crop, crop architecture, corn, soybean, cotton, peanut

PROPOSAL TYPE

**For National Research Initiative
Competitive Grants Program Proposals Only**

- Standard Research Proposal
- Conference
- AREA Award
- Postdoctoral
- New Investigator
- Strengthening:**
- Career Enhancement
- Equipment
- Seed Grant
- Standard Strengthening

**For Higher Education Program
Proposals Only:**

Need Area: _____

Discipline: _____

Glyphosate-resistant horseweed is a major threat to efficient crop production in the United States. The acreage infested continues to increase as horseweed produces wind-disseminated seed, is self-fertile, has no fitness penalty for glyphosate resistance, and heterozygous individuals survive recommended glyphosate rates. In addition, cropping production changes from conventional tillage towards no-till favor establishment of horseweed and winter seasonal weed species, and the widespread adoption of glyphosate-resistant crop technology has dramatically increased selection pressure for glyphosate resistance among weeds. Continued reliance on herbicides as the predominant control method will only increase the prevalence of herbicide-resistant biotypes in the United States as specific horseweed biotypes have already evolved resistance to at least six herbicide modes-of-action. In North Carolina, horseweed and winter weeds have been observed as greater problems following a no-till corn crop than other crops or conventional-tillage corn. Previous research has documented the relationship of tillage or the presence of cover crops to weed establishment, but the effects of crop architecture have not been adequately described. The proposed research will measure the spatial and temporal relationship of horseweed and other winter weeds to rotational crop species with and without the presence of a winter cover crop and with and without tillage. Results will directly improve the current best management practices for corn, soybean, cotton, and peanut production in the southeastern United States. In addition, this research will provide benefits for horseweed and winter weed management in conventional and organic crops in other regions of the United States.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average .50 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

4. Project Description.

4.A. Joint Research-Extension

4.B. Problem, Background, and Justification

Horseweed (*Conyza canadensis*) is a common biennial, summer annual, or winter annual found throughout North America (USDA, NRCS 2005). Horseweed produces prolific numbers of wind-disseminated seed that can travel great distances. In addition, horseweed germination periods during August through November and during March through May (Hayes et al. 2005; A. C. York, personal communication) coincide with vulnerable times in many cropping systems. Horseweed has high seedling vigor (USDA, NRCS 2005). Summer annual crops like corn, cotton, peanut, and soybean are especially sensitive to early season weed interference (Zimdahl 2004) as would be the case with established horseweed in no-tillage production systems. In the southern United States, horseweed is a common and problematic weed in corn, cotton, peanut, soybean, forestry, small grains, and hay and pasture production (A. C. York, personal communication; Webster 2004, 2005).

The development of glyphosate-resistant crops has allowed growers to implement simple, inexpensive, and consistently effective weed management programs (Cox et al. 2005). As a result, these programs have led to widespread adoption with over 80% of soybean acreage planted to glyphosate-resistant varieties and 95% of North Carolina cotton planted to glyphosate-resistant varieties in 2004 (Anonymous 2005; USDA-NASS 2004). The extensive use of Roundup Ready® crops in turn has increased selection pressure for glyphosate-resistant weeds with a total of nine glyphosate-resistant species worldwide, including horseweed (Heap 2005; Nandula 2005).

The first report of glyphosate-resistant horseweed occurred in 2001 in Delaware where glyphosate-resistant soybean (and glyphosate applied in-crop) had been used less than three years (VanGessel 2001). Glyphosate-resistant horseweed currently infests at least 13 states including Arkansas, California, Indiana, Kentucky, Missouri, Mississippi, North Carolina, Ohio, Pennsylvania, Tennessee, and others shown in Figure 1 (Heap 2005). It is considered one of the most important herbicide resistant species in the country, and potentially the most important in the south (Smith et al. 2005). The evolution and rapid spread of glyphosate-resistant horseweed has been attributed to prolific seed production, wind-dissimination of seeds, and its ability to colonize many settings including the increasing acreage of reduced tillage crops (Koger et al. 2004; VanGessel 2001). In addition, no fitness penalty has been reported for glyphosate resistance in horseweed, heterozygous individuals can still survive glyphosate field applications at recommended rates, horseweed is self-fertile and self-compatible, and resistance is pollen-borne (Zelaya et al. 2004). All of these factors indicate rapid proliferation of glyphosate-resistant horseweed when glyphosate is the primary control agent.

To further complicate matters, natural hybridization in *Conyza* is well documented, and glyphosate resistance has been passed to hybrids of *C. canadensis* and *C. ramosissima* (Owen and Zelaya 2005). Four *Conyza* species are present in the southern United States and sixteen members of the closely related *Erigeron* genus are present (USDA, NRCS 2005).

Herbicide resistance is not new regarding horseweed management. Populations of this weed have been reported to be resistant to six herbicide classes including photosystem II inhibitors, bipyridiliums (i.e. paraquat), ureas and amides, acetolactate synthase (ALS) inhibitors, glycines (i.e. glyphosate), and diphenylethers (Heap 2005; Weaver et al. 2004). Four of these populations have resistance to at least two distinct modes of action (Heap 2005; Weaver et al. 2004) making horseweed one of the ten most important herbicide resistant weeds in the world (Heap 2005).

Horseweed management has become much more difficult in recent years. Glyphosate and paraquat are the most commonly used herbicides for burndown control of winter weeds and cover crops, but resistant biotypes are becoming more common. Therefore currently recommended herbicides, such as the synthetic auxins (i.e. 2,4-D), are likely to have resistance issues as their use and consequently selection pressure for resistance increase. At least 24 weed species worldwide have developed resistance to the synthetic auxins (Heap 2005).

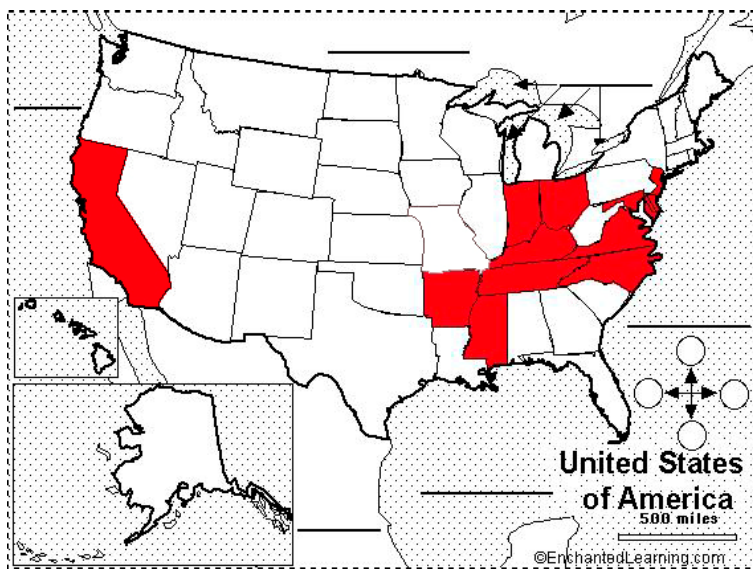


Figure 1. States (shown in red) infested with glyphosate-resistant horseweed (Heap 2005).

Field observations have indicated that horseweed, and winter weeds such as cutleaf eveningprimrose (*Oenothera laciniata*), are generally problematic in North Carolina in corn fields that have no cover crops and especially with a reduced- or no-tillage crop following corn in rotation. Additionally, these weeds are not typically found in fields following cotton, peanut, or soybean, whether they were produced in conventional or no-tillage systems. For example, surveys of fields in fall and winter of 2004 and the fall of 2005 found that 73, 2, 1, and 2% of corn, cotton, peanut, and soybean fields, respectively, were infested with horseweed and cutleaf eveningprimrose. Cutleaf eveningprimrose is an annual to perennial herbaceous plant found east of the Rocky Mountains in North America (USDA, NRCS 2005; Uva et al. 1997). It is a common and troublesome weed in soybean, corn, and small grain production in areas of the southern United States (Webster 2004, 2005), and is one of the most common and troublesome

weeds in North Carolina cotton production (Anonymous 2005). Management of this weed in reduced tillage systems is difficult (Reynolds et al. 2000). Like horseweed, cutleaf eveningprimrose is often more weedy in reduced cropping situations, and both plants can interfere with cotton growth over an entire growing season (Guy 1995). Cutleaf eveningprimrose and glyphosate-resistant horseweed are the most common complaint calls to extension weed specialists and county agents in North Carolina during May and early June in North Carolina (A. C. York, personal communication).

We feel that horseweed and cutleaf eveningprimrose is especially problematic in fields that do not receive soil disturbance in the fall, which would adversely impact horseweed and cutleaf eveningprimrose (and other winter weeds that germinate and establish seedlings in the late summer and early fall). These weeds are also more prevalent in crops like corn that senesce in early August while not being nearly as common in crops like cotton and peanut that do not senesce or are not harvested until late September/early October or soybeans (harvested in November to December). Additionally, commercial harvesting of peanuts involves digging and inversion of the crop that disturbs the soil similar to a shallow cultivation. In a similar fashion, a grain drill used to plant cover crops also disturbs the soil and would interfere with the germination of a small wind-blown seed like horseweed. We therefore hypothesize that the occurrence of horseweed and cutleaf eveningprimrose (and likely other winter annual weeds) are predictable based on cropping history and crop production systems and that these problems can be managed with an integration of crop management, cropping rotations, and cultural practices.

Integration of cultural techniques for weed management. The use of integrated cultural techniques to manage weeds may provide many benefits. By shifting the pest management burden from pesticides and tillage to ecological methods, environmental protection may be increased and certain inputs may be reduced (Liebman and Gallandt 1997). Intercrops and cover crops can decrease weed growth and competition by competing for resources and disturbing preferred niches (Liebman and Davis 2000). Cover crops may be used in a wide range of production systems (Bowman et al. 1998; Teasdale 1998; Thurston 1997), and cover crops have many benefits including: improved soil characteristics, reduced leaching and erosion, increased soil nitrogen and organic matter, improved water infiltration, improved moisture retention, and pest suppression (Liebman and Davis 2000; Mallory et al. 1998; Sainju and Singh 1997; Teasdale 1998; Varco et al. 1999; Yenish et al. 1996). A long-term Alabama study has successfully utilized cover crops in a continuous cotton production since 1896 (Mitchell et al. 2002). Cover crops can easily be combined with other management techniques and postemergence herbicide applications have been suggested to complement the early season weed suppression provided by winter rye (*Secale cereale*) cover crops (Reddy 2003).

Use of winter rye as a cover crop may be the most flexible cover crop option. It can be planted in many cropping rotations and rye can be planted later than many cover crops and still produce adequate biomass (Bowman et al. 1998). Rye may be planted in mixtures with other cover crops, including legumes (Clark 1993). Rye may reduce pest problems in crop rotations, attract beneficial insects, and rye is less prone to disease than other cereals (Bowman et al. 1998; Bugg et al. 1990; Wingard 1996). Rye as a cover crop has suppressed barnyardgrass in rice, while maximizing yield (Jordan and Bollich 2002). In addition, rye is typically cheap and easy to

purchase and relatively easy to establish (Bowman et al. 1998), thus offering convenience and cost efficiency to growers. Johnson and Webb (1987) reported that rye suppressed horseweed before establishment of full-season no-tillage soybean in Delaware. Reduced tillage systems offer several advantages over conventional tillage. These include erosion prevention, water conservation, improved soil structure, and reduced expenses from lower mechanical and labor inputs (Bradley 1995; Liebman and Gallandt 1997). Use of a rye cover crop for integrated control of horseweed and cutleaf eveningprimrose has not been evaluated in southern cropping systems as influenced by tillage and previous crop.

Furthermore, Baker (2005) reported from ongoing research that a winter rye cover crop is much more effective than spring oats for carbon sequestration before planting soybeans. The USDA, under the Federal Agricultural Improvement and Reform Act (FAIR) of 1996, recognizes the potential for increased carbon sequestration on U.S. croplands (EPA 2005). Due to FAIR and potential post-Kyoto global warming treaties or programs, U.S. government sponsored subsidies may be initiated in the near future to promote carbon sequestration on cropland, range, or forests. Post-Kyoto negotiations are currently underway in Montreal (Doyle 2005).

Summary. Glyphosate-resistant horseweed and winter weeds in general, must be controlled in order to maximize yield and income for no-tillage and reduced-tillage growers. In addition, glyphosate-resistant crops have offered many benefits to growers, and the value of this system may be improved by integrating complementary non-chemical weed control methods that minimize development of glyphosate-resistant biotypes. Utilization of crop rotations that maximize crop competitiveness combined with a winter cover crop may fit this niche without forcing growers to implement major alterations in their production systems. The spatial and temporal relationships of horseweed and other problematic winter weeds as influenced by cover crop, rotational crop species, and tillage is not well documented. Understanding these relationships will provide valuable guidance for the development of long-term sustainable weed management programs.

4.C. Objectives

Our overall goal is to determine the effect of summer rotational crop and winter cover crop practices that improve long-term management of glyphosate-resistant horseweed and other problematic winter annual weeds like cutleaf eveningprimrose.

Objective 1. Evaluate the effect of various crop canopy heights and time of crop maturity/senescence on horseweed and winter annual and biennial weed germination, establishment, and growth.

Planned accomplishments:

- Determine the effect of crop canopy (development, maturity, and senescence) on temporal relationship with horseweed germination and establishment in corn, cotton, peanut, and soybean.
- Determine the crops that suppress or facilitate horseweed germination and establishment.

Objective 2. Evaluate the effects of fall tillage and use of a winter cover crop on horseweed and winter weed germination and establishment.

Planned accomplishments:

- Determine horseweed establishment under conventional tillage and no-tillage production systems.
- Determine horseweed establishment and growth in the presence or absence of a winter cover crop.
- Identify any interactions between rotational crop, cover crop, and tillage that may maximize horseweed and winter weed control.

Objective 3. Disseminate research findings.

Planned accomplishments:

- Present research findings at the Weed Science Society of America, the Southern Weed Science Society, and/or the American Society of Agronomy.
- Publish research findings in Weed Technology.
- Present updated extension recommendations to clientele through commodity and agricultural consultant meetings, and extension publications.
- Conduct field research at university research stations that host field days including the Cotton, Peanut, and Grain Field Days.

4.D. Approach and Procedures

This proposed research will be conducted at the Upper Coastal Plain Research Station located near Tarboro, NC and the Peanut Belt Research Station located near Lewiston-Woodville, NC. Both stations have a history of glyphosate-resistant horseweed infestations and other important winter weeds such as cutleaf eveningprimrose. The experimental design will be a randomized complete block with a factorial treatment arrangement of four crops (corn, cotton, peanuts, and soybeans), two tillage production systems (no-till and conventional tillage), and two cover crop options (no cover crop and a rye cover crop) for a total of 16 treatments. The experiments will be established behind a corn crop in an area of high horseweed pressure. We hypothesize that soil disturbance by harvesting peanuts, or by planting and establishing the cover crop of winter rye may be interfering with germination and establishment of horseweed in the fall. This methodology will allow us to determine how much horseweed germination and establishment is inhibited by the cover crop and planting (soil disturbance) and how much can be inhibited by the specific rotational crops.

We further hypothesize that horseweed and cutleaf eveningprimrose germinate and successfully establish in corn as opposed to the other crops because corn senescence begins in early August and the resulting open canopy allows successful winter weed germination and establishment. Cotton, peanut, and soybean do not senesce or are harvested till late September/early October (cotton and peanut) or November (soybean). These crops are typical for southeastern coastal plain crop production. The cotton, corn, and soybean varieties will be glyphosate-resistant varieties selected for yield, grade parameters where applicable, and other important appropriate traits based on North Carolina's Official Variety Testing Trials (OVT). The peanut variety will not be glyphosate resistant as this trait and other transgenic traits are not available in peanut, the peanut variety will also be selected based on OVT trials.

The 16 treatments will be replicated four times and the study will be repeated in time. The first trial will begin in fall 2006 and end in fall 2008. The study repetition will begin in fall 2007 and end in fall 2008. Crop production systems including fertilization, planting, and general (non-

weed) pest management will be managed according to North Carolina Cooperative Extension Service recommendations with corn planted in 36-inch rows at a seeding density of 2 seed/ft of row, cotton in 36-inch rows at 4 seed/ft of row, peanuts in 36-inch rows at 4 seed/ft of row, and soybeans in 18 cm rows at 2 seed/ft of row. These row spacings and plant populations are in accordance with state extension recommendations. All plots will be 24 feet wide and 40 feet in length and of sufficient size to allow for the potential of appreciable horseweed, cutleaf eveningprimrose, and other winter weed infestations.

Soon after crop emergence (within 5 days) and throughout the entire year at biweekly intervals, horseweed and other problematic winter weeds such as cutleaf eveningprimrose populations will be determined for each plot by counting the numbers of plants by species. Data collected will include weed counts and densities by species spatially in each plot throughout the year. Weeds will be mapped by hand with DGPS and seed-rain and weed biomass by species for each treatment will be determined and quantified. To our knowledge, no one has investigated the spatial and temporal relationships of horseweed and other problematic winter weeds as influenced by tillage, crop, and cover crop. These holistic relationships need to be examined to increase our biological and ecological understandings of this important weed problem (horseweed) and other problematic winter weeds (such as cutleaf eveningprimrose). A better understanding of these relationships will allow for optimization of control inputs while minimizing herbicide use.

Light measurements including quantity and quality will be taken at the same biweekly intervals to assess the effects of different crops and cover crop light interception on horseweed and other winter weed germination and establishment. Light readings will be taken at the soil surface, at the top of the crop or cover crop canopy, and at the average height of the horseweed population. Weather data (daily means, high and low temperatures, relative humidity) will be taken. Additionally soil temperature (daily mean, high, and low temperatures will be taken in one plot of each representative treatment) to provide data for better understanding the temporal relationships of environment on horseweed and other problematic species germination and establishment as influenced by different crops.

This project will use multiple resources to provide growers with the research results and the proper information to implement improved management strategies. We will hold research plot field tours as part of field days hosted by commodity groups including the Cotton, Peanut, and Grain Field Days at the respective research stations. An average of 200 growers are expected to attend at least 3 separate field day events where this research will be displayed. The second extension method will involve creation and distribution of printed materials. Handouts and extension materials will be created and disseminated to growers. Documents will also published online to allow for wider access. Current extension publications, including crop production and pest management guides, will be updated based on the findings of this research.

Information from this research will also be shared with extension and research faculty in North Carolina and at regional and national levels. This will allow extension personnel to provide growers with updated information. In addition, research results will be presented at professional meetings including the American Peanut Research and Education Society, the American Society of Agronomy, the Beltwide Cotton Conference, the Southern Weed Science Society, and/or the

Weed Science Society of America. Research findings will also be published in Weed Technology, upon completion of this study.

Project Timetable

2006. Summer. Confirm study arrangements with research stations. Obtain all necessary materials and mark experimental areas. **Fall.** Initiate field research and plant cover crop.

2007. Spring. Plant crops. Begin data collection. **Summer.** Continue data collection. **Fall.** Crop harvest. Plant cover crop. Summarize data from year 1.

2008. Spring. Plant crops. Begin data collection. **Summer.** Continue data collection. Display trial to growers at research station field day. Begin preparation of extension publications and manuscript. **Fall.** Crop harvest. Complete extension publications and manuscript.

Assessment

Once the research is completed, it will be published in appropriate state research and extension bulletins and will stress the economic feasibility and viability of this approach. By showing a significant reduction in herbicide inputs (at least 25%), protecting crop yield potential and quality, and improving net economic returns to land and management, we estimate that this management approach will be adopted by 20% of our acreage within 5 years.

4.E. Cooperation and Institutional Units Involved

North Carolina State University has all necessary resources to complete this project as described.

6. References

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8. Key Personnel-

a. Roles and responsibilities for PDs and collaborators:

Rob Richardson, PD. Coordinate study activities and management; fulfill requirements of all objectives; coordinate associated outreach and extension activities; advise graduate student.

John Wilcut, co-PD. Coordinate study activities and management; fulfill requirements of objectives 1 and 2; co-advise graduate student if necessary. Provide weed science research expertise for corn, cotton, soybeans, and peanut.

Alan York, co-PD. Provide weed science extension expertise for corn, cotton, and soybeans. Fulfill requirements for objective 3 as related to corn, cotton, and soybean production.

David Jordan, co-PD. Provide agronomic expertise and weed science extension expertise in peanut production. Fulfill requirements for objective 3 as related to peanut production.

b. Vitae attached for:

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M. S., Agricultural Education, Virginia Polytechnic Institute and State University, College of Human Resources and Education, Blacksburg, VA, May 1997.

B. S., Forestry and Wildlife, Virginia Polytechnic Institute and State University, College of Natural Resources, Blacksburg, VA, May 1996.

Work and Research Experience

- Assistant Professor, Weed Science, North Carolina State University, Raleigh, NC, 2005 to present.
- Research Associate, Ornamental Crops and Christmas Tree Weed Control, Michigan State University, East Lansing, MI, 2002 to 2005.
- Graduate Research Assistant for Dr. Henry P. Wilson, Professor of Weed Science, Virginia Polytechnic Institute and State University, Painter, VA, 1998 to 2002.
- Agriculture/Technology Teacher for William Monroe Middle School, Stanardsville, VA, 1997 to 1998.
- Park Ranger, Prince William Forest Park, Triangle, VA, 1995.

Recent Publications

Richardson, R. J., and B. H. Zandstra. 2006. Evaluation of flumioxazin and other herbicides for weed control in *Gladiolus*. *Weed Technol.* *In press*.

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Richardson, R. J., C. M. Whaley, H. P. Wilson, and T. E. Hines. 2004. Weed control and potato (*Solanum tuberosum*) tolerance with dimethenamid isomers and other herbicides. *American Journal of Potato Res.* 81:299-304.

Richardson, R. J., H. P. Wilson, G. R. Armel, and T. E. Hines. 2003. Combinations of CGA 362622 and bromoxynil for broadleaf weed control in bromoxynil-resistant cotton (*Gossypium hirsutum*). *Weed Technol.* 17:496-502.

Richardson, R. J., H. P. Wilson, W. A. Bailey, G. R. Armel, and T. E. Hines. 2003. Glyphosate-resistant cotton, glyphosate-resistant soybean, and weed responses to applications of two glyphosate salts. *Weed Technol.* 17:560-564.

- Richardson, R. J., K. K. Hatzios, and H. P. Wilson. 2003. Absorption, translocation, and metabolism of CGA 362622 in cotton and two weeds. *Weed Sci.* 51:157-162.
- Armel, G. R., H. P. Wilson, R. J. Richardson, and T. E. Hines. 2003. Mesotrione, acetochlor, and atrazine for weed management in corn (*Zea mays*). *Weed Technol.* 17:284-290.
- Armel, G. R., H. P. Wilson, R. J. Richardson, and T. E. Hines. 2003. Mesotrione alone and in mixtures with glyphosate in glyphosate-resistant corn (*Zea mays*). *Weed Technol.* 17:680-685.
- Armel, G. R., H. P. Wilson, R. J. Richardson, and T. E. Hines. 2003. Mesotrione combinations in no-till corn (*Zea mays*). *Weed Technol.* 17:111-116.
- Armel, G. R., H. P. Wilson, R. J. Richardson, and T. E. Hines. 2003. Mesotrione combinations for postemergence control of horsenettle (*Solanum carolinense*) in corn (*Zea mays*). *Weed Technol.* 17:65-72.
- Armel, G. R., H. P. Wilson, R. J. Richardson, and T. E. Hines. 2003. Use of mixtures of mesotrione, imazethapyr, and imazethapyr plus imazapyr in imidazolinone-resistant corn (*Zea mays*). *Weed Technol.* 17:674-679.

Recent Research Proposals

- Brewer, M., R. Richardson, S. Gower, J. Byrne, D. Brown-Rytlewski, B. Zandstra, and D. Smitley. 2005. Development of regionally-based educational materials for ornamental IPM. USDA – North Central Region Integrated Pest Management Program. Funded: \$72,194.
- Byrne, J., R. Richardson, S. Gower, D. Brown-Rytlewski, D. Smitley, W. Kirk, R. Cloyd, and B. Zandstra. 2005. Development of Three Pocket IPM Scouting Guides for Pest Identification in Christmas Trees, Nurseries, and Landscapes. Project GREEN. Funded: \$29,460.
- Zandstra, B. H., Richardson, R. J., D. Fulbright, and B. Cregg. 2004. Reducing use of the “at-risk” pesticides atrazine, simazine, and chlorothalonil in Christmas trees. USDA – Special Research Grants Pest Management Alternatives Research. Funded: \$151,211.
- Brown-Rytlewski, D., M. Brewer, R. J. Richardson, G. Bird, T. Dudek, D. Fulbright, W. Kirk, S. Thornsby, and B. Zandstra. 2003. Research evaluations of and outreach for methyl bromide alternatives in conifer seedlings and herbaceous perennials. USDA Methyl Bromide Alternatives. Funded: \$370,701.
- Zandstra, B. H., R. J. Richardson, D. Brown-Rytlewski, T. Dudek, T. Fernandez, S. Gower, M. Koelling, and J. O’Donnell. 2003. Annual and perennial weed management in herbaceous and woody ornamental nurseries and Christmas tree plantations. Project GREEN. Funded \$25,000.
- Zandstra, B. H., R. J. Richardson, D. Brown-Rytlewski, T. Dudek, T. Fernandez, S. Gower, M. Koelling, J. Himmelein, J. O’Donnell, and N. Myers. 2003. Increasing profits in the ornamental nursery and Christmas tree industries through effective weed control educational programs. Project GREEN. Funded \$19,000.

Professional Memberships

- Aquatic Plant Management Society (2005)
- International Weed Science Society (2003 to present)
- Michigan Invasive Plants Council (2003 to present)
- Northeastern Weed Science Society (1998 to present)
- North Central Weed Science Society (2002 to present)
- South Carolina Aquatic Plant Management Society (2005)
- Southern Weed Science Society (2000 to 2002)
- Weed Science Society of America (2001 to present)

Dr. John W. Wilcut -Vitae

I. Degrees Received:

B.S. Botany.	1978. Eastern Illinois University, Charleston, IL.
M.S. Botany.	1982. Eastern Illinois University, Charleston, IL.
Ph.D. Weed Science/ Plant Physiology	1986. Auburn University, Auburn, AL.

II. Professional positions held:

<u>Position Title</u>	<u>Employer</u>	<u>Dates</u>
Weed Scientist, Asst. Prof./ Ext. Spec.	VPI & SU	9/1987-2/1990
Weed Scientist, Asst. Prof.	Univ. of Georgia	3/1990-6/1994
Weed Scientist, Assoc. Prof.	Univ. of Georgia	7/1994-10/1994
Weed Scientist, Assoc. Prof.	NCSU	11/1994-6/2000
Weed Scientist, Professor	NCSU	7/2000-present.

III. Honors and Awards:

- Outstanding Educator, Southern Weed Science Society, 2005.
- DowAgro Research Award, American Peanut Research and Education Society, 2003.
- Fellow, Weed Science Society of America, 2003.
- Weed Scientist of the Year, Southern Weed Science Society, 2003.
- Outstanding Faculty Member Award by Agronomy Club, North Carolina State University, 1999.
- Outstanding Young Weed Scientist Award, Southern Weed Science Society, 1995.
- Outstanding Young Weed Scientist Award, Weed Science Society of America, 1994.
- The Award for Excellence for Junior Scientist. Coastal Plain Experiment, the University of Georgia, 1994.
- Bailey Award, American Peanut Research and Education Society (APRES) (author of best paper) 2005.
- Bailey Award, APRES (co-author of best paper) 1990 and 1994.
- Outstanding Presentations for Weed Science Section. American Peanut Research and Education Society (APRES)– 2004, 1999, 1995, 1992, 1989, 1988, 1986. Co-author in 2002 and 1994 (Graduate Student Paper Contest).
- Coach for NCSU Weed Teams: 1st place 1999, 2001-2004; 2nd place 1995, 1998, 2000, and 2002 (two NCSU teams in 2002) for the graduate portion of the Northeastern Weed Science Society Weed Contest, and 1st place 2002 and 3rd place 1999, for the undergraduate portion of the contest.
- Keynote address to the First International Cotton Conference in the Weed Science Section. Brisbane, Australia. Wilcut, J. W. and A. C. York. 1994. Weed management strategies for conventional and minimum tillage cotton systems.
- Peer Review Panel Member, Western IPM Competitive Grants Program (2002-2004, NorthCentral IPM Competitive Grants Program 2003).
- CSREES Review Team Member for the Department of Agronomy and Environmental Management, Louisiana State University AgCenter, Baton Rouge, March 2005.
- Review Team Member for the USDA-ARS Southern Weed Science Research Unit, Stoneville, MS, April 2005.
- Fellow, 2003 Weed Science Society of America
- 2003 Weed Scientist of the Year, Southern Weed Science Society
- 2003 DowAgroSciences Research Award, American Peanut Research and Education Society (APRES)
- 1998-1999 Outstanding Faculty Member Award by Agronomy Club, North Carolina State University, April 1999.
- Outstanding Young Weed Scientist Award, Southern Weed Science Society, January 1995.
- Outstanding Young Weed Scientist Award, Weed Science Society of America, February 1994.
- Editor, Weed Technology, February 2002-present.
- Chairperson, Economic Losses Due to Weeds, Weed Science Society of America, 2002-present.

The Award for Excellence for Junior Scientist. Coastal Plain Experiment, the University of Georgia, February 1994.

Bailey Award, 1994 APRES; J. S. Richburg, III and J. W. **Wilcut**. 1994. The behavior of Pursuit and Cadre in purple and yellow nutsedge.

Bailey Award, 1990 APRES; Phipps, P. M., D. A. Herbert, J. W. **Wilcut**, C. W. Swann, G. G. Gallimore, and D. B. Taylor. 1990. Impact of chemical-use restrictions on disease, weed, and insect management in peanuts.

Outstanding Presentation for Weed Science Section. APRES– 1999, 1995, 1992, 1989, 1988, 1986. Co-author 2002 (Graduate Student Contest), 1994, 1991.

Keynote address to the First International Cotton Conference in the Weed Science Section. Brisbane, Australia. **Wilcut**, J. W. and A. C. York. 1994. Weed management strategies for conventional and minimum tillage cotton systems. February 1994.

Gamma Sigma Delta
Phi Sigma Society

IV. Grants: >\$4,500,000 from commodity groups and the agricultural industry, Southern IPM, USEPA Region 4 Grant – Pesticide Environmental Stewardship Program, and RAMP.

Dr. Wilcut’s program is recognized for providing national leadership in the areas of weed management, weed/crop ecology and biological relationships, and in the physiological behavior of herbicides in crops and weed species important to U.S. agriculture. He has shown excellence in research, extension, and teaching at North Carolina State University, the University of Georgia, and VPI&SU. His expertise in weed science has been recognized by regulatory agencies at the state and federal level, by commodity groups in a number of states as evidenced by funding and requests for presentations, field days, and commodity meetings, and by state, regional, and national professional societies. His students have won a number of state, regional, national, and international awards for presentations and research including four students for the Outstanding M.S. Graduate Student Award (2001-2004), three additional students have received the Outstanding Graduate Student Award from the Weed Science Society of America (2002-2004), and the Outstanding Graduate Student Award from the Crop Science Society of America (2002).

Major Technical Research Publications.

CAREER SUMMARY OF PUBLICATIONS AND AUTHORSHIP

Category	Senior author	Junior to graduate student and postdoc	Junior to colleague	Total
Refereed Journal articles	28	91	42	161
Bulletins and reports	10	--	6	16
Chapters in books	5	--	--	5
Abstracts of paper	86	200	68	354
TOTAL	129	291	116	536

c. Referred Journal Articles:

*Denotes graduate student or post doctoral research associate authorship.

1. Culpepper, A. S., A. E. Gimenez, A. C. York, R. B. Batts, and J. W. **Wilcut**. 2001. Morningglory (*Ipomoea spp.*) and large crabgrass (*Digitaria sanguinalis*) control with glyphosate and 2,4-DB mixtures in glyphosate-resistant soybean (*Glycine max*). Weed Technol. 15:56-61.
2. **Wilcut**, J. W., S. D. Askew, W. A. Bailey, J. F. Spears, and T. G. Isleib. 2001. Virginia market-type peanut (*Arachis hypogaea*) cultivar tolerance and yield response to flumioxazin preemergence. Weed Technol. 15:137-140.
3. *Scott, G. H., S. D. Askew, and J. W. **Wilcut**. 2001. Economic evaluation of diclosulam and

- flumioxazin systems in peanut (*Arachis hypogaea*). *Weed Technol.* 15:360-364.
4. *McLean, H. S., J. S. Richburg, III, J. W. **Wilcut**, and A. E. Smith. 2001. Influence of norflurazon placement on yellow nutsedge (*Cyperus esculentus*). *Weed Technol.* 15:327-331.
 5. *Askew, S. D. and J. W. **Wilcut**. 2001. Tropic croton interference in cotton. *Weed Sci.* 49:184-189.
 6. *Pline, W. A., A. J. Price, J. W. **Wilcut**, K. L. Edmisten, and R. Wells. 2001. Absorption and translocation of glyphosate in glyphosate-resistant cotton as influenced by application method and growth stage. *Weed Sci.* 49:460-467.
 7. *Scott, G. H., S. D. Askew, A. C. Bennett, and J. W. **Wilcut**. 2001. Economic evaluation of HADSS™ computer program for weed management in nontransgenic and transgenic cotton. *Weed Sci.* 49:549-557.
 8. *Paulsgrove, M. D. and J. W. **Wilcut**. 2001. Weed management with pyriithobac preemergence in bromoxynil-resistant cotton. *Weed Sci.* 49:567-570.
 9. *Clewis, S. B., S. D. Askew, and J. W. **Wilcut**. 2001. Common ragweed interference in peanut. *Weed Sci.* 49: 768-772.
 10. *Scott, G. H., S. D. Askew, and J. W. **Wilcut**. 2002. Glyphosate systems for weed control in glyphosate-tolerant cotton (*Gossypium hirsutum*). *Weed Technol.* 16:191-198.
 11. *Askew, S. D., J. W. **Wilcut**, and J. Cranmer. 2002. Cotton and weed response to flumioxazin applied preplant and postemergence directed. *Weed Technol.* 16:184-190.
 12. *Price, A. J. and J. W. **Wilcut**. 2002. Weed management with diclosulam in strip-tillage peanut (*Arachis hypogaea*). *Weed Technol.* 16:29-36.
 13. *Scott, G. H., S. D. Askew, J. W. **Wilcut**, and A. C. Bennett. 2002. Economic evaluation of HADSS™ computer program in North Carolina peanut. *Weed Sci.* 50: 91-100.
 14. *Clewis, S. B., S. D. Askew, and J. W. **Wilcut**. 2002. Economic assessment of diclosulam and flumioxazin in strip- and conventional-tillage peanut. *Weed Sci.* 50: 378-385.
 15. *Askew, S. D., W. A. Bailey, G. H. Scott, and J. W. **Wilcut**. 2002. Economic assessment of weed management for transgenic and non-transgenic cotton in tilled and non-tilled environments. *Weed Sci.* 50: 512-520.
 16. *Porterfield, D., J. W. **Wilcut**, and S. D. Askew. 2002. Weed management with CGA-362622, fluometuron, and prometryn in cotton. *Weed Sci.* 50: 642-647.
 17. *Askew, S. D. and J. W. **Wilcut**. 2002. Pennsylvania smartweed interference and achene production in cotton. *Weed Sci.* 50:350-356.
 18. *Askew, S. D. and J. W. **Wilcut**. 2002. Absorption, translocation, and metabolism of foliar-applied CGA 362622 in cotton, peanut, and selected weeds. *Weed Sci.* 50:50:293-298.
 19. *Askew, S. D. and J. W. **Wilcut**. 2002. Ladysthumb interference and seed production in cotton. *Weed Sci.* 50: 326-332.
 20. *Pline, W. A., R. Viator, J. W. **Wilcut**, K. L. Edmisten, J. Thomas, and R. Wells. 2002. Reproductive abnormalities in glyphosate-resistant cotton caused by lower CP4-EPSPS levels in male reproductive tissues. *Weed Sci.* 50:438-447.
 21. *Porterfield, D., J. W. **Wilcut**, S. B. Clewis, and K. L. Edmisten. 2002. Weed-free yield response of seven cotton (*Gossypium hirsutum*) cultivars to CGA-362622 postemergence. *Weed Tech.* 16:180-183.
 22. *Pline, W. A., J. W. **Wilcut**, S. O. Duke, K. L. Edmisten, and R. Wells. 2002. Tolerance and accumulation of shikimic acid in response to glyphosate applications in glyphosate-resistant cotton (*Gossypium hirsutum* L.). *J. Agric. Food Chem.* 50:506-512.
 23. *Askew, S. D. and J. W. **Wilcut**. 2002. Pale smartweed interference and achene production in cotton. *Weed Sci.* 50:357-363.
 24. *Pline, W. A., J. W. **Wilcut**, K. L. Edmisten, and R. Wells. 2002. Physiological and morphological response of glyphosate-resistant and non-glyphosate resistant cotton seedlings to root-absorbed glyphosate. *Pestic Biochem. & Physiol.* 73:48-58.
 25. *Price, A. J., J. W. **Wilcut**, and J. R. Cranmer. 2002. Flumioxazin preplant burndown weed management in strip-tillage (*Gossypium hirsutum*) planted into wheat (*Triticum aestivum*). *Weed Technol.* 16:762-767.

26. *Bailey, W. A. and John W. **Wilcut**. 2002. Diclosulam systems for weed management in peanut (*Arachis hypogaea* L.). *Weed Technol.* 16:807-814.
27. *Pline, W. A., J. W. **Wilcut**, and K. L. Edmisten. 2002. Postemergence weed control in soybean (*Glycine max*) with cloransulam-methyl and diphenyl ether herbicides. *Weed Tech.* 16:737-742.
28. *Pline, W. A., K. L. Edmisten, T. Oliver, J. W. **Wilcut**, R. Wells, and N. S. Allen. 2002. Use of digital image analysis, viability stains, and germination assays to estimate conventional and glyphosate-resistant cotton pollen viability. *Crop Sci.* 42:2193-2200. *Featured on journal cover.*
29. *Corbett, J. L., S. D. Askew, D. Porterfield, and J. W. **Wilcut**. 2002. Weed management in cotton with bromoxynil, pyriithiobac, MSMA, and prometryn. *Weed Technol.* 16:712-718.
30. *Burke, I. C., S. D. Askew, and J. W. **Wilcut**. 2002. Flumioxazin systems for weed management in North Carolina peanut (*Arachis hypogaea*). *Weed Technol.* 16:743-748.
31. *Price, A. J., J. W. **Wilcut**, and C. W. Swann. 2002. Weed management with diclosulam in peanut (*Arachis hypogaea*). *Weed Technol.* 16:724-730.
32. *Burke, I. C., J. W. **Wilcut**, and D. Porterfield. 2002. CGA-362622 antagonizes annual grass control with clethodim. *Weed Technol.* 16:749-754.
33. *Troxler, S. C., S. D. Askew, J. W. **Wilcut**, W. D. Smith, and M. D. Paulsgrove. 2002. Clomazone, fomesafen, and bromoxynil systems for bromoxynil-resistant cotton (*Gossypium hirsutum*). *Weed Technol.* 16:838-844.
34. *Bailey, W. A., S. D. Askew, S. Dorai-Raj, and J. W. **Wilcut**. 2003. Velvetleaf interference and seed production dynamics in cotton. *Weed Sci.* 51:94-101.
35. *Pline, W. A., K. L. Edmisten, J. W. **Wilcut**, R. Wells, and J. F. Thomas. 2003. Glyphosate-induced reductions in pollen viability and seed set in glyphosate-resistant cotton (*Gossypium hirsutum* L.) and attempted remediation by gibberellic acid treatments. *Weed Sci.* 51:19-27.
36. *Troxler, S. C., I. C. Burke, J. W. **Wilcut**, and W. D. Smith. 2003. Absorption, translocation, and metabolism of foliar-applied CGA-362622 in purple and yellow nutsedge (*Cyperus rotundus* and *C. esculentus* L.). *Weed Sci.* 51: 13-18.
37. *Bailey, W. A., J. W. **Wilcut**, and R. M. Hayes. 2003. Weed management, fiber quality, and net returns in no-tillage transgenic and non-transgenic cotton (*Gossypium hirsutum*). *Weed Technol.* 17: 117-126.
38. Howell, J. E., B. B. Shew, M. A. Cubeta, and J. W. **Wilcut**. 2003. Weed species as hosts of *Sclerotinia minor* in peanut fields. *Plant Dis.* 87:197-199.
39. *Bailey, W. A. and J. W. **Wilcut**. 2003. Tolerance of imidazolinone-resistant corn (*Zea mays*) to diclosulam. *Weed Technol.* 17:60-64.
40. *Burke, I. C., W. E. Thomas, J. F. Spears, and J. W. **Wilcut**. 2003. Influence of environmental factors on after-ripened crowfootgrass (*Dactyloctenium aegyptium*) seed germination. *Weed Sci.* 51: 342-347.
41. *Burke, I. C. and J. W. **Wilcut**. 2003. Physiological basis for antagonism of clethodim by CGA-362622. *Weed Sci.* 51: 671-677.
42. *Pline, W. A., R. Wells, G. Little, K. L. Edmisten, and J. W. **Wilcut**. 2003. Glyphosate and water stress effects on fruiting and carbohydrates in glyphosate-resistant cotton. *Crop Sci.* 43: 879-885.
43. *Burke, I. C., W. E. Thomas, J. F. Spears, and J. W. **Wilcut**. 2003. Influence of environmental factors on broadleaf signalgrass (*Bracharia platyphylla*) germination. *Weed Sci.* 51: 683-689.
44. *Porterfield, D. and J. W. **Wilcut**. 2003. Peanut (*Arachis hypogaea*) response to CGA-362622. *Weed Technol.* 17: 441-445.
45. *McElroy, J. S., F. H. Yelverton, S. C. Troxler, and J. W. **Wilcut**. 2003. Selective exposure of yellow and purple nutsedge to postemergence treatments of CGA-362622, imazaquin, and MSMA. *Weed Technol.* 17: 554-559.
46. *Burke, I. C. and J. W. **Wilcut**. 2003. Physiological basis for antagonism of clethodim by imazapic on goosegrass (*Eleusine indica* (L.) Gaertn.). *Pest. Biochem. & Phys* 76: 37-45.
47. *Price, A. J., W. A. Pline, J. W. **Wilcut**, J. R. Cranmer, and D. A. Danehower. 2004. Physiological basis for cotton tolerance to flumioxazin applied postemergence-directed. *Weed Sci.* 52:1-7.
48. *W. E. Thomas, S. D. Askew, and J. W. **Wilcut**. 2004. Tropic croton interference in peanut. *Weed Technol.* 18:119-123.

49. *Burke, I. C., A. J. Price, J. W. **Wilcut**, D. L. Jordan, A. S. Culpepper, and J. Tredaway-Ducar. 2004. Annual grass control in peanut (*Arachis hypogaea*) with clethodim and imazapic. *Weed Technol.* 18:88-92.
50. *McElroy, J. S., F. H. Yelverton, T. W. Gannon, and J. W. **Wilcut**. 2004. Foliar vs. soil exposure of green and false-green kyllinga to postemergence treatments of CGA-262622, halosulfuron, imazaquin, and MSMA. *Weed Technol.* 18:145-151.
51. *Burke, I. C. and J. W. **Wilcut**. 2004. Weed management in cotton (*Gossypium hirsutum*) with CGA-362622, fluometuron, and pyriithiobac. *Weed Technol.* 18:268-276.
52. *Corbett, J., S. D. Askew, W. E. Thomas, and J. W. **Wilcut**. 2004. Weed efficacy evaluations for bromoxynil, glufosinate, glyphosate, pyriithiobac, and sulfosate. *Weed Technol.* 18:443-453.
53. *Pline, W. A., K. L. Edmisten, J. W. **Wilcut**, R. Wells, J. F. Thomas, and R. Sederoff. 2004. Fruit retention, yield, fiber quality, lignin content, and basis for 'cavitation' in glyphosate-resistant cotton as affected by glyphosate. *Cotton Sci.* 8:24-32.
54. *Price, A. J., J. W. **Wilcut**, and J. R. Cranmer. 2004. Flumioxazin preplant or postemergence-directed application timing followed by irrigation at emergence or after postemergence-directed treatment does not influence cotton (*Gossypium hirsutum*) yield. *Weed Technol.* 18:310-314.
55. *Thomas, W. E., W. A. Pline, J. W. **Wilcut**, R. Viator, K. L. Edmisten, R. Wells, and M. D. Paulsgrove. 2004. Glufosinate does not affect floral morphology and pollen viability in glufosinate-resistant cotton (*Gossypium hirsutum*). *Weed Technol.* 18:258-262.
56. *Thomas, W. E. and J. W. **Wilcut**. 2004. Weed management in glyphosate-resistant corn with glyphosate, halosulfuron, and mesotrione. *Weed Technol.* 18:826-834.
57. *Price, A. J., J. W. **Wilcut**, and J. R. Cranmer. 2004. Physiological behavior of root-absorbed flumioxazin in peanut, ivyleaf morningglory, and sicklepod. *Weed Sci.* 52:718-724.
58. McElroy, J. S., F. H. Yelverton, I. C. Burke, and J. W. **Wilcut**. 2004. Absorption, translocation, and metabolism of halosulfuron and trifloxysulfuron in green kyllinga (*Kyllinga brevifolia*) and false green kyllinga (*K. gracillima*). *Weed Sci.* 52:704-710.
59. Main, C. L., T. C. Mueller, R. M. Hayes, J. W. **Wilcut**, T. F. Peeper, R. E. Talbert, and W. W. Witt. 2004. Sulfentrazone persistence in southern soils: bioavailable concentration and effect on a rotational cotton crop. *Weed Technol.* 18:346-352.
60. *Thomas, W. E., W. A. Pline-Srnic, J. F. Thomas, R. Wells, K. L. Edmisten, and J. W. **Wilcut**. 2004. Glyphosate negatively affects pollen viability but not pollination and seed set in glyphosate-resistant corn. *Weed Sci.* 52:725-734.
61. Ducar, J. T., J. W. **Wilcut**, and J. S. Richburg, III. 2004. Weed management in imidazolinone-resistant corn with imazapic. *Weed Technol.* 18:1018-1022.
62. *Thomas, W. E. and J. W. **Wilcut**. 2004. Weed management in glyphosate-resistant corn with glyphosate and halosulfuron. *Weed Technol.* 18:1049-1057.
63. *Porterfield, D., L. R. Fisher, J. W. **Wilcut**, and W. D. Smith. 2005. Tobacco (*Nicotinia tabacum* L.) response to residual and in-season treatments of CGA-362622. *Weed Technol.* 19:1-5.
64. *Thomas, W. E., I. C. Burke, B. L. Robinson, W. A. Pline-Srnic, K. L. Edmisten, R. Wells, and J. W. **Wilcut**. 2005. Yield and physiological response of nontransgenic cotton (*Gossypium hirsutum*) to simulated glyphosate drift. *Weed Technol.* 19:35-42.
65. *Thomas, W. E., W. A. Pline-Srnic, R. P. Viator, and J. W. **Wilcut**. 2005. Effects of glyphosate application timing and rate on sicklepod (*Senna obtusifolia*) fecundity. *Weed Technol.* 19:55-61.
66. Lancaster, S. H., D. L. Jordan, A. C. York, J. W. **Wilcut**, D. Monks, and R. Bradenburg. 2005. Interactions of clethodim and sethoxydim with selected agrichemicals applied to peanut. *Weed Technol.* 19:456-461.
67. Lancaster, S.H., D. L. Jordan, J. Spears, A. C. York, J. W. **Wilcut**, D. Monks, and R. Batts. 2005. Control and seed production of sicklepod (*Senna obtusifolia*) following 2,4-DB applied alone and with other agrichemicals. *Weed Technol.* 19:451-455.
68. Lancaster, S. H., D. L. Jordan, A. C. York, I. C. Burke, F. T. Corbin, Y. S. Sheldon, J. W. **Wilcut**, and D. W. Monks. 2005. Influence of selected fungicides on efficacy of clethodim and

- sethoxydim. *Weed Technol.* 19:397-403.
69. *Burke, I. C., W. E. Thomas, W. A. Pline, L. R. Fisher, W. D. Smith, and J.W. **Wilcut**. 2005. Yield and physiological response of flue-cured tobacco (*Nicotiana tabacum*) to simulated glyphosate drift. *Weed Tech.* 19:255-260.
 70. *Burke, I. C., S. C. Troxler, S. D. Askew, J. W. **Wilcut**, and W. D. Smith. 2005. Weed management systems in glyphosate-resistant cotton (*Gossypium hirsutum*). *Weed Technol.* 19:422-429.
 71. *Thomas, W. E., S. C. Troxler, W. D. Smith, L. R. Fisher, and J. W. **Wilcut**. 2005. Uptake, translocation, and metabolism of sulfentrazone in peanut, prickly sida (*Sida spinosa*), and pitted morningglory (*Ipomoea lacunosa*). *Weed Sci.* 53:446-450.
 72. *Burke, I. C., S. D. Askew, J. L. Corbett, and J. W. **Wilcut**. 2005. Glufosinate antagonizes clethodim control of goosegrass (*Eleusine indica*). *Weed Technol.* 19:685-689.
 73. *Paulsgrove, M. D., W. L. Barker, and J. W. **Wilcut**. 2005. Bromoxynil-resistant cotton and selected weed response to mixtures of bromoxynil and pyriithiobac. *Weed Technol.* 19:774-782
 74. Koger, C. H., D. L. Shaner, W. B. Henry, T. Nadler-Hassar, W. E. Thomas, and J. W. **Wilcut**. 2005. Assessment of two nondestructive assays for detecting glyphosate resistance in horseweed (*Conyza canadensis*). *Weed Sci.* 53:438-445.
 75. *Thomas, W. E., S. C. Troxler, W. D. Smith, L. R. Fisher, and J. W. **Wilcut**. 2005. Uptake, translocation, and metabolism of sulfentrazone in peanut, prickly sida, and pitted morningglory. *Weed Sci.* 53:446-450.
 76. Miller, D. K., R. G. Downer, E. Burris, J. W. **Wilcut**, and D. R. Cook. 2005. Trifloxysulfuron-insecticide combination effects on broadleaf weed and thrips (*Frankliniella spp.*) control in cotton. *Weed Technol.* 19:762-767.
 77. *Porterfield, D. and J. W. **Wilcut**. 2005. Corn (*Zea mays*) response to trifloxysulfuron. *Weed Technol.* 19: (in press).
 78. *Clewis, S. B., J. W. **Wilcut**, and D. Porterfield. 2005. Weed management with S-metolachlor and glyphosate mixtures in glyphosate-resistant strip- and conventional-tillage cotton (*Gossypium hirsutum*). *Weed Technol.* 19: (in press).
 79. *Thomas, W. E., T. Britton, S. B. Clewis, S. D. Askew, and J. W. **Wilcut**. 2005. Glyphosate-resistant cotton response and management with trifloxysulfuron and glyphosate. *Weed Technol.* 19 (in press).
 80. Lancaster, S.L., D. L. Jordan, A. C. York, J. W. **Wilcut**, R. Bradenburg, and D. W. Monks. 2005. Interactions of late-season morningglory (*Ipomoea spp.*) management practices in peanut (*Arachis hypogaea*). *Weed Technol.* 19: (in press).

Alan C. York
William Neal Reynolds Professor of Crop Science
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Education:

Degree	Institution	Major Field	Year
B.S.	North Carolina State Univ.	Agronomy	1974
M.S.	North Carolina State Univ.	Crop/Weed Science	1976
Ph.D.	University of Illinois	Agronomy/Weed Science	1979

List of Academic Positions:

Year	Organization	Position
1979-present	North Carolina State University	Weed Science Extension and Research

Membership in Professional Societies:

Beltwide Cotton Weed Science Research Conference
Crop Protection Association of North Carolina
Gamma Sigma Delta
National Association of County Agricultural Agents
Phi Kappa Phi Honor Society
Weed Science Society of America
Southern Weed Science Society
Georgia Association of County Agricultural Agents
Georgia Crop Production Alliance
Georgia Fruit and Vegetable Growers Association

Honors and Awards:

Distinguished Service Award; Weed Science Society of North Carolina, 1989
Outstanding Extension Service Award; North Carolina State University, 1991
Outstanding Young Weed Scientist Award; Southern Weed Science Society, 1991
State Distinguished Service Award; Epsilon Sigma Phi, 1991
Cotton Extension Education Award; The Cotton Foundation, 1992
Ag Consultant Hall of Fame; Ag Consultant Magazine, 1995
Walton S. Dennis Award for Environmental Stewardship; Pesticide Association of North Carolina, 1995
Outstanding Extension Award; Weed Science Society of America, 1997
Certificate of Excellence for extension publication, American Society of Agronomy, 1998
Certificate of Excellence for extension publication, American Society of Agronomy, 1999
William Neal Reynolds Distinguished Professor, College of Agriculture and Life Sciences, NCSU, 2001
Distinguished Service Award, Southern Weed Science Society, 2002
Honorary Membership, Alpha Zeta Fraternity, North Carolina State University Chapter, 2002

Publications (Career):

Refereed Journal Articles: 88	Book Chapters: 5
Abstracts: 206	Extension Publications: 232

PUBLICATIONS (SINCE 2001)

Refereed Journals

- Bradley, A. L.** , **A. C. York**, F. H. Yelverton, A. S. Culpepper, and R. B. Batts. 2001. Fluometuron carryover to flue-cured tobacco following application to cotton. *J. Cotton Sci.* 5:184-196.
- Culpepper, A. S., A. E. Gimenez, **A. C. York**, R. B. Batts, and J. W. Wilcut. 2001. Morningglory (*Ipomoea* spp.) and large crabgrass (*Digitaria sanguinalis*) control with glyphosate and 2,4-DB mixtures in glyphosate-resistant soybean (*Glycine max*). *Weed Technol.* 15:56-61.
- Stewart, A. M.** , K. L. Edmisten, R. Wells, D. L. Jordan, and **A. C. York**. 2001. Wick applicator for applying mepiquat chloride on cotton: I. Rate response of wick and spray delivery systems. *J. Cotton Sci.* 5:9-14.
- Stewart, A. M.** , K. L. Edmisten, R. Wells, **A. C. York**, and D. L. Jordan. 2001. Wick applicator for applying mepiquat chloride on cotton: II. Use in existing mepiquat chloride management strategies. *J. Cotton Sci.* 5:15-21.
- Culpepper, A. S., **A. C. York**, J. L. Marth, and F. T. Corbin. 2001. Effect of insecticides on clomazone absorption, translocation, and metabolism in cotton. *Weed Sci.* 49:613-616.
- Beam, J. B.** , D. L. Jordan, **A. C. York**, J. E. Bailey, T. G. Isleib, and T. E. McKemie. 2002. Interaction of prohexadione calcium with agrichemicals applied to peanut (*Arachis hypogaea* L.). *Peanut Sci.* 29:29-35.
- Beam, J. B.** , D. L. Jordan, **A. C. York**, T. G. Isleib, J. E. Bailey, T. E. McKemie, J. F. Spears, and P. D. Johnson. 2002. Influence of prohexadione calcium on pod yield and pod loss of peanut. *Agron. J.* 94:331-336.
- Krings, A., M. G. Burton, and **A. C. York**. 2002. *Commelina benghalensis* (*Commelinaceae*) new to North Carolina and an updated key to Carolina congeners. *SIDA* 20:419-422.
- Crooks, H. L.** , **A. C. York**, A. S. Culpepper, and C. Brownie. 2003. CGA-362622 antagonizes annual grass control by graminicides in cotton (*Gossypium hirsutum*). *Weed Technol.* 17:373-380.
- Crooks, H. L.** , **A. C. York**, and D. L. Jordan. 2003. Wheat (*Triticum aestivum*) tolerance and Italian ryegrass (*Lolium multiflorum*) control by AE F130060 00 plus AE F115008 00 mixed with other herbicides. *Weed Technol.* 17:881-889.
- Clemmer, K. C.** , **A. C. York**, and C. Brownie. 2004. Italian ryegrass (*Lolium multiflorum*) control in imidazolinone-resistant wheat. *Weed Technol.* 18:481-489.
- Crooks, H. L.** , **A. C. York**, and D. L. Jordan. 2004. Wheat (*Triticum aestivum*) tolerance and Italian ryegrass (*Lolium multiflorum*) control with AE F130060 00 plus AE F115008 00 applied in nitrogen. *Weed Technol.* 18:93-99.
- Crooks, H. L.** , **A. C. York**, and D. L. Jordan. 2004. Tolerance of six soft red winter wheat cultivars to AE F130060 00 plus AE F115008 00. *Weed Technol.* 18:252-257.
- Crooks, H. L.** , **A. C. York**, and D. L. Jordan. 2004. Wheat (*Triticum aestivum*) tolerance to AE F130060 00 plus AE F115008 00 as affected by time of application and rate of the safener AE F107892. *Weed Technol.* 18:841-845.
- Culpepper, A. S., J. T. Flanders, **A. C. York**, and T. M. Webster. 2004. Tropical spiderwort (*Commelina benghalensis*) control in glyphosate-resistant cotton. *Weed Technol.* 18: 432-436.
- Culpepper, A. S., T. M. Webster, **A. C. York**, R. M. Barentine, and B. G. Mullinex, Jr. 2004. Glyphosate/MSMA mixtures in glyphosate-resistant cotton (*Gossypium hirsutum*). *J. Cotton Sci.* 8:124-129.
- York, A. C.**, A. S. Culpepper, D. T. Bowman, and O. L. May. 2004. Performance of glyphosate-tolerant cotton cultivars in official cultivar trials. *J. Cotton Sci.* 8:261-270.
- York, A. C.**, A. S. Culpepper, and A. M. Stewart. 2004. Response of strip-tilled cotton to preplant applications of dicamba and 2,4-D. *J. Cotton Sci.* 8:213-222.
- York, A. C.**, A. M. Stewart, P. R. Vidrine, and A. S. Culpepper. 2004. Control of volunteer glyphosate-resistant cotton in glyphosate-resistant soybean. *Weed Technol.* 18:532-539.
- Crooks, H. L.** , M. G. Burton, **A. C. York**, and C. Brownie. 2005. Vegetative growth and competitiveness of ALS-resistant and -susceptible common cocklebur. *J. Cotton Sci.* 9: (in press).
- Culpepper, A. S., S. Carlson, and **A. C. York**. 2005. Pre-plant control of cutleaf eveningprimrose and wild radish in conservation tillage cotton. *J. Cotton Sci.* 9: (in press).
- Lancaster, S. H.** , D. L. Jordan, J. F. Spears, **A. C. York**, J. W. Wilcut, D. M. Monks, R. B. Batts, and R. L. Brandenburg. 2005. Sicklepod (*Senna obtusifolia*) control and seed production following 2,4-DB applied alone and with fungicides or insecticides. *Weed Technol.* 19:451-455.

- Lancaster, S. H.** , D. L. Jordan, A. C. York, I. C. Burke, F. T. Corbin, Y. S. Sheldon, J. W. Wilcut, and D. W. Monks. 2005. Influence of selected fungicides on efficacy of clethodim and sethoxydim. *Weed Technol.* 19:397-403.
- Lancaster, S. H.** , D. L. Jordan, **A. C. York**, J. W. Wilcut, R. L. Brandenburg, and D. W. Monks. 2005. Interactions of late-season morningglory (*Ipomoea* spp.) management practices in peanut. *Weed Technol.* 19: (in press).
- Lancaster, S. H.** , D. L. Jordan, **A. C. York**, J. W. Wilcut, D. M. Monks, and R. L. Brandenburg. 2005. Interactions of clethodim and sethoxydim with selected agrichemicals applied to peanut. *Weed Technol.* 19:456-461.
- Parker, R. G.** , **A. C. York**, and D. L. Jordan. 2005. Comparison of glyphosate products in glyphosate-resistant cotton and corn. *Weed Technol.* 19: (in press).
- Stewart, A. M., **A. C. York**, A. S. Culpepper, and P. R. Vidrine. 2005. Response of glyphosate-resistant cotton to pre-harvest glyphosate application. *J. Cotton Sci.* 9:110-114.
- Webster, T. M., M. G. Burton, A. S. Culpepper, **A. C. York**, and E. P. Prostko. 2005. Tropical spiderwort (*Commelina benghalensis*): a tropical invader threatens agroecosystems of the southern United States. *Weed Technol.* 19:501-508.
- York, A. C.**, J. B. Beam, and A. S. Culpepper. 2005. Control of volunteer glyphosate-resistant soybean in cotton. *J. Cotton Sci.* 9:102-109.

** Denotes graduate student as senior author.

NAME: David Lindley Jordan

ACADEMIC RANK: Associate Professor

EDUCATION:

<u>Institution:</u>	<u>Years:</u>	<u>Degrees:</u>	<u>Major:</u>
University of Arkansas	1988-1992	PhD	Agronomy
North Carolina State University	1986-1988	MS	Crop Science
North Carolina State University	1983-1985	BS	Agronomy
Chowan College	1982-1983	AS	Associate of Science

ACADEMIC AND PROFESSIONAL APPOINTMENTS:

<u>Rank/Position:</u>	<u>Place:</u>	<u>Dates:</u>
Associate Professor, Extension Specialist	NCSU	2002-present
Assistant Professor, Extension Specialist	NCSU	1996-2002
Assistant Professor	LSU AG CENTER	1993-1996

Areas of Specialization:

Production, cropping systems, fertilization, tillage, plant growth regulation, and integrated pest management relative to peanut.

Present Appointment: 70% Extension, 20% Research, 10% Teaching

PRESENT PROGRAM EMPHASIS AND GOALS:

Research

- Evaluate plant growth regulators.
- Develop and refine integrated pest management strategies for peanuts in cooperation with other faculty in the College of Agriculture and Life Sciences.
- Develop weed management strategies with emphasis on new weed control technologies.
- Evaluate irrigation systems that include subsurface drip and overhead sprinkler irrigation.
- Evaluate interactions among planting patterns, seeding rates, and varieties.
- Evaluate interactions among agrichemicals.
- Evaluate relationships of soil fertility and pod yield and quality characteristics.
- Evaluate carryover potential of herbicides applied to rotation crops.
- Evaluate economic and biological implications of peanut-based cropping systems.
- Evaluate tillage systems.
- Develop management strategies for efficient kenaf production
- Participate at state, regional, and national meetings including the American Society of Agronomy, the Peanut Research and Education Society, and the Southern Weed Science Society.

Teaching

- Instructor for CS 052 (Weed Control in Field Crops).
- Instructor for CS 063 (Peanut Production).
- Co-instructor for CS 590B/795B (Cotton, Peanut, and Tobacco Production Systems).
- Guest lecture in graduate level weed management courses.
- Guest lecture in production courses in the BS and Agricultural Institute programs.
- Serve on graduate student committees in various departments in the College of Agriculture and Life Sciences.
- Direct MS and PhD students.

Extension

- Direct statewide educational programs related to weed management and production principles in peanuts.
- Assist Cooperative Extension field faculty with their county programs as related to peanut production issues. Involvement in county production meetings and field tours, establishing on-farm tests, providing updated literature on production and pest management practices, and assisting with problem solving situations are involved in this assistance.
- Coordinate publication of *Peanut Information* and other appropriate extension publications.

AWARDS AND HONORS (Career):

Outstanding Graduate Student Teaching Assistant, 1987

Gamma Sigma Delta

Outstanding Young Scientist, Weed Science Society of America, 2003

Outstanding Young Weed Scientist, Southern Weed Science Society 2004

Epsilon Sigma Phi 2004 XI Chapter Early Career Award 2004

APPOINTMENTS AND SERVICE:

Associate Editor, *Peanut Science* (1999-present)

Associate Editor, *Agronomy Journal* (1999-2001)

Associate Editor, *Journal of Production Agriculture* (1997-1999)

Associate Editor, *Weed Technology* (2002-2004)

Board of Directors, Southern Weed Science Society (1997-1999)

Board of Directors, American Peanut Research and Education Society (2001-2003)

President, Weed Science Society of North Carolina, 1999-2000

Representative to the Weed Science Society of America Board of Directors from the Southern Weed Science Society (2005-present)

PUBLICATIONS LAST FOUR YEARS:

Refereed Journals

Jordan, D.L., J.S. Barnes, C.R. Bogle, T.M. Marshall, T. Corbett, C.R. Crozier, B. McLawhorn, and L. Fisher. 2005. Influence of cultural practices and crop rotation on kenaf yield in North Carolina. Online Crop Management. doi-10.1094/CM-2005-0913-01-RS

- Lancaster, S.H., **D.L. Jordan**, A.C. York, J.W. Wilcut, R.L. Brandenburg, and D.W. Monks. 2005. Interactions of late-season morningglory (*Ipomoea* spp.) management practices in peanut (*Arachis hypogaea*). *Weed Technol.* 19: (in press)
- Lancaster, S.H., **D.L. Jordan**, J.F. Spears, A.C. York, J.W. Wilcut, D.W. Monks, R.B. Batts, and R.L. Brandenburg. 2005. Sicklepod (*Senna obtusifolia*) control and seed production following 2,4-DB applied alone and with fungicides or insecticides. *Weed Technol.* 19:451-455.
- Lancaster, S.H., **D.L. Jordan**, A.C. York, J.W. Wilcut, D.W. Monks, and R.L. Brandenburg. 2005. Interactions of clethodim and sethoxydim with selected agrichemicals applied to peanut. *Weed Technol.* 19:456-461.
- Lancaster, S.H., **D.L. Jordan**, A.C. York, I.C. Burke, F.T. Corbin, Y.S. Sheldon, J.W. Wilcut, and D.W. Monks. 2005. Influence of selected fungicides on efficacy of clethodim and sethoxydim. *Weed Technol.* 19:397-403.
- Lanier, J.E., **D.L. Jordan**, J.F. Spears, R. Wells, and P.D. Johnson. 2005. Peanut response to inoculation and nitrogen fertilizer. *Agron. J.* 97:79-84.
- Hurt, C.A., R.L. Brandenburg, **D.L. Jordan**, G.G. Kennedy, and J.E. Bailey. 2004. Cultural Management practices to manage tomato spotted wilt virus in virginia market type peanut. *Peanut Sci.* 31:100-106.
- Hurt, C.A., R.L. Brandenburg, **D.L. Jordan**, G.G. Kennedy, and J.E. Bailey. 2004. Management of tomato spotted wilt virus vector *Frankliniella fusca* (Thysanoptera:Thripidae) in virginia market type peanut. *J. Econ. Entomol.* 98:1435-1440.
- Crooks, H.L., A.C. York, and **D.L. Jordan**. 2004. Wheat (*Triticum aestivum*) tolerance and Italian ryegrass (*Lolium multiflorum*) control by AE F130060 00 plus AE F115008 00 mixed with other herbicides. *Weed Technol.* 18:(accepted)
- Crooks, H.L., A.C. York, and **D.L. Jordan**. 2004. Wheat (*Triticum aestivum*) tolerance and Italian ryegrass (*Lolium multiflorum*) control with AE F130060 00 plus AE F115008 00 applied in nitrogen. *Weed Technol.* 18:(accepted)
- Crooks, H.L., A.C. York, and **D.L. Jordan**. Tolerance of six soft red winter wheat (*Triticum aestivum*) cultivars to AE F130060 00 plus AE F115008 00. *Weed Technol.* 18: (accepted)
- Crooks, H.L., A.C. York, and **D.L. Jordan**. Wheat (*Triticum aestivum*) tolerance to AE F130060 00 plus AE F115008 00 as affected by time of application and rate of the safener AE F107892. *Weed Technol.* (accepted)
- Linscombe, S.D., **D.L. Jordan**, A.B. Burns, and R.P. Viator. 2004. Rice response to planting date differs at two locations in Louisiana. *Crop Management* (most likely accepted)
- Jordan, D.L.**, J.B. Beam, J.E. Lanier, S.R. Hans, and P.D. Johnson. 2004. Peanut (*Arachis hypogaea*) response to cyclanilid and prohexadione calcium. *Peanut Sci.* 31: (most likely accepted)
- Beasley, J.P., Jr., W.J. Grichar, **D.L. Jordan**, R.G. Lemon, B.A. Besler, K.D. Brewer, J.B. Beam, P.D. Johns, and J.E. Paulk, III. 2004. Peanut (*Arachis hypogaea*) response to the hormone plant growth regulator Early Harvest[®]. *Peanut Sci.* 30: (most likely accepted)
- Jordan, D.L.**, J.F. Spears, and J.W. Wilcut. 2003. Tolerance of peanut (*Arachis hypogaea*) to herbicides applied postemergence. *Peanut Sci.* 30: (in press)
- Jordan, D.L.**, A.S. Culpepper, W.J. Grichar, J. Tredaway-Ducar, B.J. Brecker, and A.C. York. 2003. Weed control with combinations of selected fungicides and herbicides applied postemergence to peanut (*Arachis hypogaea*). *Peanut Sci.* 30: (in press)
- Jordan, D. L.**, G. G. Wilkerson, and D. W. Krueger. 2003. Evaluation of scouting methods in peanut (*Arachis hypogaea*) using theoretical net returns from HADSS. *Weed Technol.* 17: (in press)
- Jordan, D.L.**, J.S. Barnes, C.R. Bogle, R.L. Brandenburg, J.E. Bailey, P.D. Johnson, and A.S. Culpepper. 2002. Peanut response to cultivar selection, digging date, and tillage intensity. *Agron. J.* 94: (in press)

- Jordan, D.L.**, J.E. Bailey, J.S. Barnes, C.R. Bogle, S.G. Bullen, A.B. Brown, K.L. Edmisten, E.J. Dunphy, and P.D. Johnson. 2002. Yield and economic return of ten peanut-based cropping systems. *Agron. J.* 94:1289-1294.
- Beam, J.B., **D.L. Jordan**, A.C. York, J.E. Bailey, T.G. Isleib, and T.E. McKemie. 2002. Interactions of prohexadione calcium with agrichemicals applied to peanut (*Arachis hypogaea*). *Peanut Sci.* 29:29-34.
- Baughman, T.A., W.J. Grichar, and **D.L. Jordan**. 2002. Tolerance of virginia-type peanut to different application timings of 2,4-DB. *Peanut Sci.* 29: (in press)
- Beam, J.B., **D.L. Jordan**, A.C. York, T.G. Isleib, J.E. Bailey, T.E. McKemie, J.F. Spears, and P.D. Johnson. 2002. Influence of prohexadione calcium on pod yield and pod loss of peanut. *Agron. J.* 94:331-336.

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET - Summary

ORGANIZATION AND ADDRESS North Carolina State University, 2701 Sullivan Drive; Suite 240 Raleigh, NC 27695-7514				USDA AWARD NO.			
PROJECT DIRECTOR(S) Robert J. Richardson Box 7620 Williams Hall Raleigh, NC 27695-7620				DURATION PROPOSED MONTHS: ____ Funds Requested by Proposer	DURATION PROPOSED MONTHS: ____ Funds Approved by CSREES (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages	CSREES-FUNDED WORK MONTHS						
	Calendar	Academic	Summer				
1. No. Of Senior Personnel							
a. ____ (Co)-PD(s).....							
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates							
b. ____ Other Professionals							
c. ____ Paraprofessionals							
d. <u>1</u> Graduate Students				36,900			
e. <u>1</u> Prebaccalaureate Students.....				15,400			
f. ____ Secretarial-Clerical							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages →				52,300			
B. Fringe Benefits (If charged as Direct Costs)				6,161			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				58,461			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				7,500			
F. Travel				5,000			
G. Publication Costs/Page Charges				2,000			
H. Computer (ADPE) Costs				0			
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)				10,018			
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J) →				82,979			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)				0			
M. Total Direct and F&A/Indirect Costs (K plus L) →				82,979			
N. Other →							
O. Total Amount of This Request →				82,979			
P. Carryover -- (If Applicable) Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)			DATE
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

BUDGET – YR 1

ORGANIZATION AND ADDRESS North Carolina State University, 2701 Sullivan Drive; Suite 240 Raleigh, NC 27695-7514				USDA AWARD NO.			
PROJECT DIRECTOR(S) Robert J. Richardson Box 7620 Williams Hall Raleigh, NC 27695-7620				DURATION PROPOSED MONTHS: _12_	DURATION PROPOSED MONTHS: ____	Non-Federal Proposed Cost-Sharing/Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages		CSREES-FUNDED WORK MONTHS					
		Calendar	Academic	Summer			
1. No. Of Senior Personnel							
a. ____ (Co)-PD(s).....							
b. ____ Senior Associates					-		
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates					-		
b. ____ Other Professionals					-		
c. ____ Paraprofessionals					-		
d. _1_ Graduate Students					18,000		
e. _1_ Prebaccalaureate Students.....					7,700		
f. ____ Secretarial-Clerical					-		
g. ____ Technical, Shop and Other.....					-		
Total Salaries and Wages →					25,700		
B. Fringe Benefits (If charged as Direct Costs)					3,022		
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →					28,722		
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies					4,500		
F. Travel					2,000		
G. Publication Costs/Page Charges					0		
H. Computer (ADPE) Costs					0		
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)					4,887		
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J) →					40,109		
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)					0		
M. Total Direct and F&A/Indirect Costs (K plus L) →					40,109		
N. Other →					0		
O. Total Amount of This Request →					40,109		
P. Carryover -- (If Applicable) Federal Funds: \$		Non-Federal funds: \$		Total \$			
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)			DATE
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

BUDGET – YR 2

ORGANIZATION AND ADDRESS North Carolina State University, 2701 Sullivan Drive; Suite 240 Raleigh, NC 27695-7514				USDA AWARD NO.			
PROJECT DIRECTOR(S) Robert J. Richardson Box 7620 Williams Hall Raleigh, NC 27695-7620				DURATION PROPOSED MONTHS: <u>12</u>	DURATION PROPOSED MONTHS: _____	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages				CSREES-FUNDED WORK MONTHS			
				Calendar	Academic	Summer	
1. No. Of Senior Personnel							
a. ____ (Co)-PD(s).....							
b. ____ Senior Associates							-
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates							-
b. ____ Other Professionals							-
c. ____ Paraprofessionals							-
d. <u>1</u> Graduate Students							18,900
e. <u>1</u> Prebaccalaureate Students.....							7,700
f. ____ Secretarial-Clerical							-
g. ____ Technical, Shop and Other.....							-
Total Salaries and Wages →							26,600
B. Fringe Benefits (If charged as Direct Costs)							3,139
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →							29,739
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies							3,000
F. Travel							3,000
G. Publication Costs/Page Charges							2,000
H. Computer (ADPE) Costs							0
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							5,131
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J) →							42,870
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							0
M. Total Direct and F&A/Indirect Costs (K plus L) →							42,870
N. Other →							
O. Total Amount of This Request →							42,870
P. Carryover -- (If Applicable) Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)			DATE
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

12.b. Budget narrative

A. Salary and Wages.

Funding is requested over 2 years for a Master of Science research assistant stipend and required health insurance and fringe benefits. The proposed research will be the focus of a thesis for this student. While supervised by the research faculty, the graduate research assistant will be in charge of establishing the research plan and will be responsible for the successful completion of the research objectives. A 5% inflationary increase is requested in year two. As mandated by NCSU, tuition and fees are requested (allocated in 'other direct costs' line item).

-Graduate Student Stipend \$36,900

In addition, funding for an undergraduate research assistant is requested to provide labor in support of the project. This student employee will assist in data collection, data input, as well as research plot establishment and maintenance. Salary of \$10/hr for approximately 12 hr/wk during the academic year and 20 hr/wk during summer (\$7,700/yr).

-Undergrad Salary \$15,400

B. Fringe Benefits.

Fringe benefits defined by NCSU for graduate students in the amount of 13% of the requested stipend include health insurance, workers compensation, and FICA/OASI. For undergraduate employees, the fringe benefit rate is 8.85% and includes FICA/OASI.

-Graduate fringe benefits \$4,797

-Undergrad fringe \$1364

C. Total Salaries. \$58,461

E. Materials and Supplies. \$7,500

Funding is requested for supplies including, but not limited to fertilizer, pesticides, plot marking stakes, sample bags, pesticide applicator personal protective equipment (less than \$5,000), field data recorder, safety gloves, and related safety supplies for field work.

F. Travel. \$5,000

Travel from the NCSU campus in Raleigh, NC, to the study locations will be needed with an average roundtrip distance of 180 miles. Numerous trips for data collection will be required in each year of the study and overnight lodging may be required for some trips. Support is also required for the grad student and PIs to attend and present research results at the 2008 Weed Science Society of America meeting.

G. Publication Costs. \$2000

This will cover publication of results in refereed journals upon project completion and support updated extension publications reflecting the research findings.

I. Student Assistance/Support.

Graduate student tuition as established by NCSU.

In-state tuition: 2006 - \$4,887; 2007 - \$5,131

**Southern Region Competitive Grants Program
Budget Form for Joint Research-Extension Proposals**

**Integrated methods for sustainable control of glyphosate-resistant horseweed
(*Conyza canadensis*) and other problematic winter weeds
Year 1**

	PL89-106 (Research)	Smith-Lever (Extension)	Total
A. Salaries and Wages			
Other personnel			
1 Graduate student	\$16,200	\$1,800	\$18,000
1 Undergraduate student	\$7,700	\$0	\$7,700
Total Salaries and Wages	\$23,900	\$1,800	\$25,700
B. Fringe Benefits	\$2,788	234	\$3,022
C. Total Salaries, Wages and Fringe Benefits	\$26,688	\$2,034	\$28,722
D. Nonexpendable Equipment	\$0	\$0	\$0
E. Materials and Supplies	\$4,000	\$500	\$4,500
F. Travel	\$1,500	\$500	\$2,000
G. Publication Costs/Page Charges	\$0	\$0	\$0
H. Computer (APDE) Costs	\$0	\$0	\$0
I. Student Assistance/Support	\$4398	\$489	\$4,887
J. All Other Direct Costs	\$0	\$0	\$0
K. Total Requested	\$36,586	\$3,523	\$40,109

Use a separate form for each year of funding requested and tally the years on a cumulative form.

No carryover of Research or Joint Research-Extension funds is permitted beyond Year 3 of any grant.

**Southern Region Competitive Grants Program
Budget Form for Joint Research-Extension Proposals**

**Integrated methods for sustainable control of glyphosate-resistant horseweed
(*Conyza canadensis*) and other problematic winter weeds
Year 2**

	PL89-106 (Research)	Smith-Lever (Extension)	Total
A. Salaries and Wages			
Other personnel			
1 Graduate student	\$17,010	\$1,890	\$18,900
1 Undergraduate student	\$7,700	\$0	\$7,700
Total Salaries and Wages	\$24,710	\$1,890	\$26,600
B. Fringe Benefits	\$2,893	\$246	\$3,139
C. Total Salaries, Wages and Fringe Benefits	\$27,603	\$2,136	\$29,739
D. Nonexpendable Equipment	\$0	\$0	\$0
E. Materials and Supplies	\$2,500	\$500	\$3,000
F. Travel	\$2,000	\$1,000	\$3,000
G. Publication Costs/Page Charges	\$1,000	\$1,000	\$2,000
H. Computer (APDE) Costs	\$0	\$0	\$0
I. Student Assistance/Support	\$4,618	\$513	\$5,131
J. All Other Direct Costs	\$0	\$0	\$0
K. Total Requested	\$37,721	\$5,149	\$42,870

Use a separate form for each year of funding requested and tally the years on a cumulative form.

No carryover of Research or Joint Research-Extension funds is permitted beyond Year 3 of any grant.

**Southern Region Competitive Grants Program
Budget Form for Joint Research-Extension Proposals**

**Integrated methods for sustainable control of glyphosate-resistant horseweed
(*Conyza canadensis*) and other problematic winter weeds
Summary**

	PL89-106 (Research)	Smith-Lever (Extension)	Total
A. Salaries and Wages			
Other personnel			
1 Graduate student	\$33,210	\$3,690	\$36,900
1 Undergraduate student	\$15,400	\$0	\$15,400
Total Salaries and Wages	\$48,610	\$3,690	\$52,300
B. Fringe Benefits	\$5,681	\$480	\$6,161
C. Total Salaries, Wages and Fringe Benefits	\$54,291	\$4,170	\$58,461
D. Nonexpendable Equipment	\$0	\$0	\$0
E. Materials and Supplies	\$6,500	\$1,000	\$7,500
F. Travel	\$3,500	\$1,500	\$5,000
G. Publication Costs/Page Charges	\$1,000	\$1,000	\$2,000
H. Computer (APDE) Costs	\$0	\$0	\$0
I. Student Assistance/Support	\$9,016	\$1,002	\$10,018
J. All Other Direct Costs	\$0	\$0	\$0
K. Total Requested	\$74,307	\$8,672	\$82,979

Use a separate form for each year of funding requested and tally the years on a cumulative form.

No carryover of Research or Joint Research-Extension funds is permitted beyond Year 3 of any grant.