VALIDATION OF COMPETITIVE INDICES USED TO PREDICT PEANUT (*Arachis hypogaea*) YIELD LOSS DUE TO WEEDS IN OKLAHOMA

By

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INTRODUCTION

This thesis was written to facilitate publication in *Weed Technology*, a journal of the Weed Science Society of America.

VALIDATION OF COMPETITIVE INDICES USED TO PREDICT PEANUT (*Arachis hypogaea*) YIELD LOSS DUE TO WEEDS IN OKLAHOMA

Validation of Competitive Indices Used to Predict Peanut (*Arachis hypogaea*) Yield Loss Due to Weeds in Oklahoma

John B. Willis

Abstract: A limited number of weed interference experiments in Oklahoma peanut have been published. This study was conducted in three environments to test the usefulness of multi species, single density experiments to measure weeds relative competitive abilities within a crop and to validate the current competitive indices (CI) used in Oklahoma's model to predict yield loss due to weeds. This model is utilized by Herbicide Application Decision Support System (HADSS) and Pesticide Economic and Environmental Tradeoffs (PEET), the two decision-support systems (DSS) available for use in Oklahoma peanut. Eight weeds were used that are common weeds in Oklahoma peanut and were: barnyardgrass, common cocklebur, crownbeard, eclipta, ivyleaf morningglory, johnsongrass, Palmer amaranth, and prickly sida. Each weed species was planted into the crop at a common density of eight weeds/10 m of row. Yield loss data generated from these studies was compared to the yield loss predicted by the model to test the accuracy of the original CI. Protected LSD was used to determine if weed treatment means were significantly different from the prediction model. Significant difference's were noted, and the CI for those weed species were adjusted. The CI were adjusted so that the mean treatment yield loss was relocated directly on the model line. Adjustments to CI improved goodness of fit of raw data to the model. The CI changes that should be considered by the DSS support staff are eclipta from 1.8 to 4.5 and ivyleaf morningglory from 3.4 to 5. CI for the other weeds included in the trials were viewed as reasonably accurate and no adjustments for them should be considered with the information at hand. Collecting data

for several weed species planted in a crop at a uniform density provides an efficient method for gathering relative weed interference data; this method is useful in validating or creating CI lists in areas and/or crops with limited previous research.

Nomenclature: Barnyardgrass, *Echinochloa crus-galli* (L.) Beauv. #[1] ECHCG; common cocklebur, *Xanthium strumarium* L. # XANST; crownbeard, *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex Gray # VEEEN; eclipta, *Eclipta prostrata* L. # ECLAL; ivyleaf morningglory, *Ipomoea hederacea* (L.) Jacq. # IPOHE; johnsongrass, *Sorghum halepense* (L.) Pers. # SORHA; Palmer amaranth, *Amaranthus palmeri* S. Wats. # AMAPA; prickly sida, *Sida spinosa* L. # SIDSP; peanut, *Arachis hypogaea* L. 'Tamspan 90'.

Additional index words: Competition, decision-support system, interference, yield loss prediction model, *Amaranthus palmeri*, *Echinochloa crus-galli*, *Eclipta prostrata*, *Ipomoea hederacea*, *Sida spinosa*, *Sorghum halepense*, *Verbesina encelioides*, *Xanthium strumarium*, AMAPA, ECLAL, ECHCG, IPOHE, SIDSP, SORHA, VEEEN, XANST.

Abbreviations: CI, competitive indices; DSS, decision-support system; HADSS, Herbicide Application Decision Support System; PEET, Pesticide Economic and Environmental Tradeoffs; TCL, total competitive load.

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[1]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

When a decision-support system (DSS) is adapted to a new region and/or crop, many factors in that system require adjustments to reflect the regions environment, growing conditions, weed species, relative competitive ability of weeds, herbicide labels, herbicide rates, and herbicide efficacy (Monks et al. 1995; Mortensen and Coble 1991; Rankins et al. 1998; White and Coble 1997). Two DSSs were adapted for use in weed control decisions for Oklahoma cotton (*Gossypium hirsutum* L.) and peanut (Murdock 2002). Herbicide Application Decision Support System (HADSS) was made available for use in 2001 for cotton and peanut weed control decisions in Oklahoma. HADSS was originally developed at North Carolina State University (Sturgill et al. 2002) and is one of the most popular weed control DSSs. Its databases have been modified for use in corn (*Zea mays* L.), cotton, peanut, and/or soybean [*Glycine max* (L.) Merr.] in several states including Alabama, Arkansas, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and/or Texas (Sturgill et al. 2002). Pesticide Economic and Environmental Tradeoffs (PEET) of herbicide application was developed by Oklahoma State University and was available for public use in 2002 (Nofziger et al. 1998). PEET is a multiple-objective DSS that enables the evaluation of profitability and pesticide hazard while making weed control decisions. PEET warns its user of any potential hazards of recommended products e.g., poisoning potential, herbicide label limitations, and groundwater hazards specific to the soil type used (Nofziger et al. 1998). PEET and HADSS use the yield loss prediction model described by Wilkerson et al. (1991) and by Coble and Mortensen (1992). Both DSSs use the same databases as modified by Oklahoma State University staff in 1999 to fit Oklahoma cotton and peanut production

(Murdock and Murray 2000; Murdock 2002). The present database has less than 1% commonality with the original HADSS database developed for North Carolina (Murdock 2002). Total competitive load (TCL) is the factor in the yield loss prediction model that accounts for weed competition. TCL is the product of competitive indices (CI) and weed density per unit area, in a single weed species situation. CI are assigned to each weed that could be present in a given region, on a scale of 0 to 10. CI of 0 indicate that the weed does not compete with the crop, and CI of 10 are assigned to the most competitive weeds in that crop and region.

The interference data used to create CI lists has traditionally been obtained in two ways, i.e., from experiments with natural weed populations (usually mixed) and from single weed density and duration studies. White and Coble (1997) conducted research to validate the CI database for HERB in North Carolina peanut. Trials were established with grass weeds only, broadleaf weeds only, and grass and broadleaf weeds mixed. Estimating new CI improved the model's fit to actual yield data from a R^2 of 0.37 to 0.61. Unmodified HERB (not an acronym) DSS developed for North Carolina soybean predicted yield losses within 10% of actual yield losses on only 10% of modeling runs and overestimated yield losses on 62% of runs in validating the program for Mississippi soybean (Rankins et al. 1998). As a result of that work the CI were adjusted to fit Mississippi growing conditions more closely based on available literature and scientists' knowledge. Natural weed population trials do measure multi species competition; however, such studies are not useful in accessing the relative competitive abilities of individual species. Oklahoma State University scientists made changes to the CI lists in 1999 to adapt the North Carolina cotton and peanut versions of HADSS to those crops for Oklahoma. When available, adjustments were made based on weed interference data. When no data were available, university scientists judgment was implemented. Extensive weed interference data in Oklahoma cotton were available. Nine weeds interference/competitive abilities had been researched and published by duration and/or density in Oklahoma cotton. Those weeds were buffalobur (*Solanum rostratum* Dun.) (Rushing et al. 1985a), hogpotato [*Hoffmanseggia glauca* (Ortega) Eifert] (Castner et al. 1989), ivyleaf morningglory (Wood et al. 1999), johnsongrass (Wood et al. 2002), Palmer amaranth (Rowland et al. 1999), silverleaf nightshade (*Solanum elaeagnifolium* Cav.) (Green et al. 1987), tumble pigweed (*Amaranthus albus* L.) (Rushing et al. 1985b), devil's claw [*Proboscidea louisianica* (Mill.) Thellung] (Mercer et al. 1987), and velvetleaf (*Abutilon theophrasti* Medik.) (Smith et al. 1990a). The scientists involved were confident that the CI list generated for cotton using those studies in Oklahoma cotton were reasonably accurate, and experiments were conducted to validate them (Murdock 2002).

Oklahoma's first peanut weed interference work was conducted by Hill and Santelmann (1969). They found that interference from a natural infestation of large crabgrass [*Digitaria sanguinalis* (L.) Scop.] and smooth pigweed (*Amaranthus hybridus* L.) significantly reduced Spanish peanut yield when left uncontrolled for 4 wk after emergence. Silverleaf nightshade caused a 4.5% yield loss per week of interference in peanut (Hackett et al. 1987a). Horsenettle (*Solanum carolinense* L.) caused a 3% yield reduction per week of interference for Spanish peanuts (Hackett et al. 1987b). Time of removal studies are useful in establishing critical period; however, such studies are not useful in accessing the relative competitive abilities among species and assignment of CI.

Only one perennial weed and one annual weed have been researched and published in single weed by density interference trials in Oklahoma peanut, these trials are the most useful in establishment of CI. Hackett et al. (1987b) also found that a 1% Spanish peanut yield loss resulted for each horsenettle plant/10m of row. Farris and Murray (2003) reported that each crownbeard plant/10m of row reduced peanut yield by 1.6%. Such studies are very time consuming, costly, and labor intensive. Each weed requires 2 to 3 yr and many man-hours to collect both duration and density data. Due to the lack of interference data for Oklahoma peanut, the CI list was adjusted almost entirely on the judgment of university scientists who used literature and data from other crops, from other regions, and personal experience to judge relative weed interference in Oklahoma peanut. Before this study, little evidence exists that the CI list was accurate for the crop in this state.

In the past, data was gathered to create CI lists specific to crops and regions by single weed studies or by natural weed population studies with several weed species in the same plot. No study of which we are aware has used multiple weed species in separate plots, planted into the crop at the same density. This study was conducted to test the usefulness of multi species, single density experiments to collect relative weed interference data for several species in an efficient way in regions and/or crops where little or none has been done previously. A second objective was to validate the current CI database for Oklahoma peanut and/or to provide some justification for adjusting it to better predict yield loss due to weed interference.

MATERIALS AND METHODS

Experiments were established on the Caddo Research Station near Fort Cobb, OK, and on the Agronomy Research Station near Perkins, OK, in 2002 and 2003. The experiments near Fort Cobb were conducted on a Cobb fine sandy loam (a fine-loamy, mixed, active, thermic Typic Haplustalfs). The soil pH was 6.4 and 6.6 and the organic matter content was 0.3 and 0.4% in 2002 and 2003, respectively. At the Perkins in 2003, the peanut yield was destroyed by American crow (Corvus brachyrhynchos), no further report will be made from this experiment. The experiment near Perkins in 2002 was conducted on a Teller fine sandy loam (a fine-loamy, mixed, active, thermic Udic Argiustolls). The soil pH was 6.0, and the organic matter content was 0.5%. A Spanish peanut cultivar, 'Tamspan 90', was planted at the seeding rate of 90 kg/ha in all experiments. Peanut was planted on beds near Fort Cobb and without beds near Perkins. Planting dates were May 16, 16, and 15 for near Fort Cobb 2002, 2003, and near Perkins 2002, respectively.

Metolachlor was applied preemergence at 1.7 kg ai/ha at all locations to control nontreatment weeds in all experiments. The future weed transplant locations had been covered before herbicide application with a paper disk 23 cm in diameter to ensure no herbicide effects on the transplanted weeds. This procedure was used successfully in previous research (Pawlak et al. 1990; Wood et al. 1999). Nontreatment weeds that escaped the metolachlor were controlled by other means. Paraquat was applied at 0.44 kg ai/ha to control emerged weeds at the experiments near Fort Cobb in 2002 before weeds were transplanted. Later in that growing season, clethodim was applied at 0.14 kg ai/ha to control emerged grasses at the experiments near Fort Cobb and Perkins. Styrofoam cups secured by a plot stake were placed over the treatment grass weeds before that clethodim application, for protection from herbicide injury. Clethodim was also used at 0.14 kg ai/ha, at Fort Cobb in 2003 before weed transplanting. Nontreatment weeds were controlled by hand weeding for the remainder of the 2002 and 2003 growing seasons. Irrigation was applied when soil was visually dry at both locations and years. Precipitation totals, including irrigation, for the peanut growing seasons were 71.1, 60.68, and 63.8 cm for experiments near Fort Cobb 2002, 2003, and Perkins 2002, respectively. Disease and insect pests were managed depending upon need at the locations. Treatments were arranged in randomized complete block designs with four replications. Plots were four rows wide and 13 m long; row spacing was 0.91 m. Data were collected from the center two plot rows from each plot while rows one and four served as border rows. End-row effect was eliminated by removing 1.5 m of the row from each end of the plot; thus, the harvested area was two rows 0.91 m wide by 10 m.

Treatments included the first, second, third, fourth, sixth, and seventh most common weed species found in Oklahoma peanut, i.e., Palmer amaranth (representing "Pigweed spp."), prickly sida, crownbeard, eclipta, ivyleaf morningglory (representing "Morningglory spp."), and johnsongrass, respectively. Four of those are also found on the "most troublesome" list for Oklahoma peanut, i.e., eclipta, Palmer amaranth (representing "Pigweed spp."), crownbeard, and prickly sida rank second, fifth, sixth, and tenth, respectively (Webster 2001). Yellow nutsedge (*Cyperus esculentus* L.), the fifth most common and first most troublesome weed in Oklahoma peanut, was not included in order to prevent contamination of research station fields. Common cocklebur and barnyardgrass were also used as treatments, even though they appear on neither list. Common cocklebur was chosen because it is viewed as the most competitive weed in several crops and it is considered the bench mark species for predicting yield loss (Royal et al. 1997; Wilkerson et al. 1991). Barnyardgrass was included to represent the important annual grasses. Smith et al. (1990b) reported that barnyardgrass, large crabgrass, and Texas panicum (*Panicum texanum* Buckl.) interfered similarly with grain sorghum [*Sorghum bicolor* (L.) Moench] grown in Oklahoma. Even though barnyardgrass is not listed among the top ten most common or troublesome weeds in Oklahoma peanut, it was included as a representative of both the eighth most common weed, crabgrass spp. (*Digitaria* spp.), and the ninth most common and troublesome weed, Texas panicum. The selected weed species were transplanted into the crop at a constant density of 8 weeds/10 m of row in 2002. Weeds were planted at a density of 8 weeds/10 m of row, additional densities of 4 and 12 common cocklebur/10 m of row were included in the 2003 Fort Cobb experiment, due to a significant difference observed in 2002 Perkins experiment. Two weed-free check treatments were included in each replication to provide a basis for calculating yield loss.

Early in 2002 preliminary experiments were conducted to determine the germination requirements for each weed, and to ensure adequate and viable seed stocks of each weed. For each experiment weeds were planted in Jiffy-7® peat pellets[2] before transplanting into the plots. Weeds were transplanted into the crop approximately 2 wk after peanut emergence; the crop and weeds were at approximately the same growth stage. Weed transplant locations were marked 5 to 8 cm from the row on alternating sides of the row in the center two plot rows. Before peanut digging, the treatment weeds were removed from the plots at the soil surface and placed into a forage drier for 1 wk. Due to the viny growth habit of ivyleaf morningglory, efforts to separate the weed from the peanut were abandoned; therefore, it was not included in the weed biomass analysis. Dry weed

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[2]Forestry Suppliers, Inc., P. O. Box 8397, Jackson, MS 39284.

biomass weights were recorded as *kg/plot*. Peanut plants were dug and inverted, using conventional equipment, and allowed to field cure October 4, 14, and 7, near Fort Cobb 2002, 2003, and near Perkins 2003, respectively. Peanuts were combined using standard equipment and placed in a peanut drier for 5 d. In-shell peanut yield was recorded as kg/plot. Plot weights were converted to percent yield loss relative to the check plots for analysis. Weed biomass was analyzed as kg/plot. Data were subjected to ANOVA using PROC MIXED (SAS 1999-2001). PROC REG (SAS 1999-2001) was used to test for goodness of fit to the linear regression model, weed biomass vs. percent yield loss. Treatment yield loss percentage means were compared to the model using the protected LSD at the 0.05 probability level. If the mean data point for a weed species lay beyond the LSD range from the prediction model, then that weed was considered significantly different from the model. CI adjustments were considered for weeds significantly outside the LSD range. R^2 values were calculated to test for goodness of fit of the raw data to the model using original CI vs. the adjusted CI to demonstrate that the adjustments improved the models predictive ability. CI changes that were recommended for consideration were made on a trial basis in PEET DSS to test those adjustments consequences on DSS recommendations and projected economic gain.

RESULTS AND DISCUSSION

In a combined ANOVA of the three experiments, a significant treatment by experiment interaction was revealed; however, a subanalysis of the two experiments near Fort Cobb detected no significant interaction. As a consequence, data from near Fort Cobb was pooled over years, and data from near Perkins was analyzed separately.

Dry Weed Biomass. Regression analyses among the seven weeds included in this analysis revealed significant ($P \leq 0.05$) positive linear responses between dry weed biomass and percentage in-shell peanut yield loss (Figures 1 and 2). Variation in dry weed biomass accounted 90 and 77% of the variation in percentage of yield loss near Fort Cobb and Perkins, respectively. As weed biomass increased, yield loss increased. For each kg of dry weed biomass produced per plot, yield loss increased by 4.18 and 4.00% near Fort Cobb and Perkins, respectively. The ability of weed species to produce greater biomass in the presence of the crop is an accurate estimator of its ability to effectively compete with that crop, and also accounts for a difference in species competitive ability between the locations. Current yield loss prediction models used in DSS have no input for weed biomass; however, if it were used, it would be a very cumbersome measurement for growers and scouts to obtain. This measurement does offer promise as a means for researchers to compare species ability to compete by comparing their abilities to produce biomass.

Measuring Original CI Accuracy. Near Fort Cobb, percentage in-shell peanut yield losses for two weed species were significantly different from the yield loss prediction model (Figure 3). The LSD at the 0.05 probability level was 13.3% at that location. The model underestimated yield loss for ivyleaf morningglory and eclipta by 15.1 and 21.5%, respectively. The LSD near Perkins was 11.7%, and a significant difference was observed for two weed species (Figure 4). Johnsongrass yield loss was 13.6% greater than the model predicted and common cocklebur yield loss was overestimated by 14.1%. Those weed species which showed significant differences from the model are candidates to have adjustments in their respective CI. Such adjustments could improve actual yield loss fit to the model. It may be more important to realize that several weed species were not significantly different from the yield loss prediction model. Those species respective CI can be regarded, within the limitations of these experiments, as reasonably accurate, and changes in them would not be justified.

Common Cocklebur. A significant difference was detected for common cocklebur between the model prediction and actual yield loss near Perkins in 2002. This prompted the addition of two more common cocklebur density treatments in the 2003 experiment. Common cocklebur is commonly viewed as the most competitive weed in Oklahoma peanut and thus assigned a CI of 10. Due to its status as a benchmark species for predicting yield loss this weed's CI must be as accurate as possible. As a result of the experiment near Fort Cobb in 2003, no model or CI adjustments were apparently needed for this location, because the mean yield losses of common cocklebur densities of 4, 8, and 12 weeds per 10 m, were considered no different from the model prediction (Figure 5). The yield loss prediction model accounted for 67% of the variation in the Common cocklebur density treatments. This may not be true for the area near Perkins, where the original discrepancy was observed.

Adjusting CI. Adjustments in CI were made on a trial basis as a consequence of the results from both locations. CI adjustments were an attempt to improve the model's "goodness of fit" as estimated by the R^2 values for each location. Recall that TCL is equal to the product of CI and weed density per unit area. The actual mean percent yield loss for the weeds determined to be significantly different from the yield loss prediction model were inserted into the model formula and solved for TCL. Once TCL was achieved, it was divided by weed density per area, CI was the result of this final operation. CI for eclipta and ivyleaf morningglory were changed from 1.8 and 3.4 to, 4.5 and 5, respectively, based on the significant differences observed near Fort Cobb. Those changes improved the R^2 from Fort Cobb from 0.61 to 0.73; however, the same changes lowered the Perkins R^2 from 0.61 to 0.37. CI for common cocklebur and johnsongrass were changed from 10 to 5.8 and 3.0 to 4.6, respectively, based on the results from near Perkins. Those changes improved the Perkins R^2 from 0.61 to 0.75; however, the same change lowered the Fort Cobb R^2 from 0.61 to 0.54. The CI estimates originally given to the weed species tested were reasonably accurate. However, these trials determined that certain weed species were more or less competitive, than originally estimated by Oklahoma State University scientists. CI adjustment at a location for the weed species which were significantly different from the model improved the model's predictive ability for that location. However, the same changes at the other location was harmful to the predictive ability of the model. This indicates that two separate CI adjustments should be made distinct to the regions of Oklahoma where the data were collected. The changes based on the data collected near Perkins will not be recommended, because only one year of data support these adjustments. The adjustments based on data collected near Fort Cobb were based on two years of collected data. The adjustments that improved the predictive ability near Fort Cobb were harmful near Perkins; this indicates that these changes should not be made in that region. Interstate 35 is a typical east/west boundary for Oklahoma. The CI adjustments that improved the model near Fort Cobb should be considered for the region of Oklahoma west of Interstate 35.

CI Adjustment Consequences in DSS Recommendations. The changes in CI that improved model fit at Fort Cobb were made on a trial basis in the PEET DSS. The top ten control recommendations respective to projected economic gain from control were noted before and after adjustment of CI (no data shown). When adjusted from 1.8 to 4.5, eclipta control recommendations were not greatly effected. The order based on economic return had only two recommendations switch places as a consequence of adjustment, neither was the highest economic returning recommendation. When adjusted from 3.4 to 5, ivyleaf morningglory control recommendations were in the same order. However, the projected economic gain for both weeds control increased, due to the increase in potential yield loss from that weeds competition with the crop. This does not mean that adjusting CI for other weed species should not be considered. CI change of some other weeds that could be found to be different from the model could impact the control recommendations and economic gain from control for other weeds.

Comparing yield loss data across several weed species at the same density provided a useful means for gathering interference data simultaneously for several weeds. These procedures could be used to adapt yield loss prediction models and create or improve CI lists for different crops and regions where weed interference data is limited. Using the data gathered in these trials, the Oklahoma peanut CI list originally estimated by Oklahoma State University scientists was reasonably accurate; however, with CI changes, the accuracy of the model could be improved. As evidence develops that questions the predictive ability of the DSS, adjustments should be made to improve the model. The weed species that showed significant differences from the model in these trials could be further researched to more accurately estimate their competitive ability and further refine the CI list. CI's will not be the same for every growing condition in every year and environment, nor is it feasible to assign CI to every possible situation. It is important to remember that these DSS are meant to provide yield loss estimates, economic thresholds, and herbicide recommendations for growers and extension agents. DSS are tools for growers to use; they are not meant to replace human knowledge and experience.

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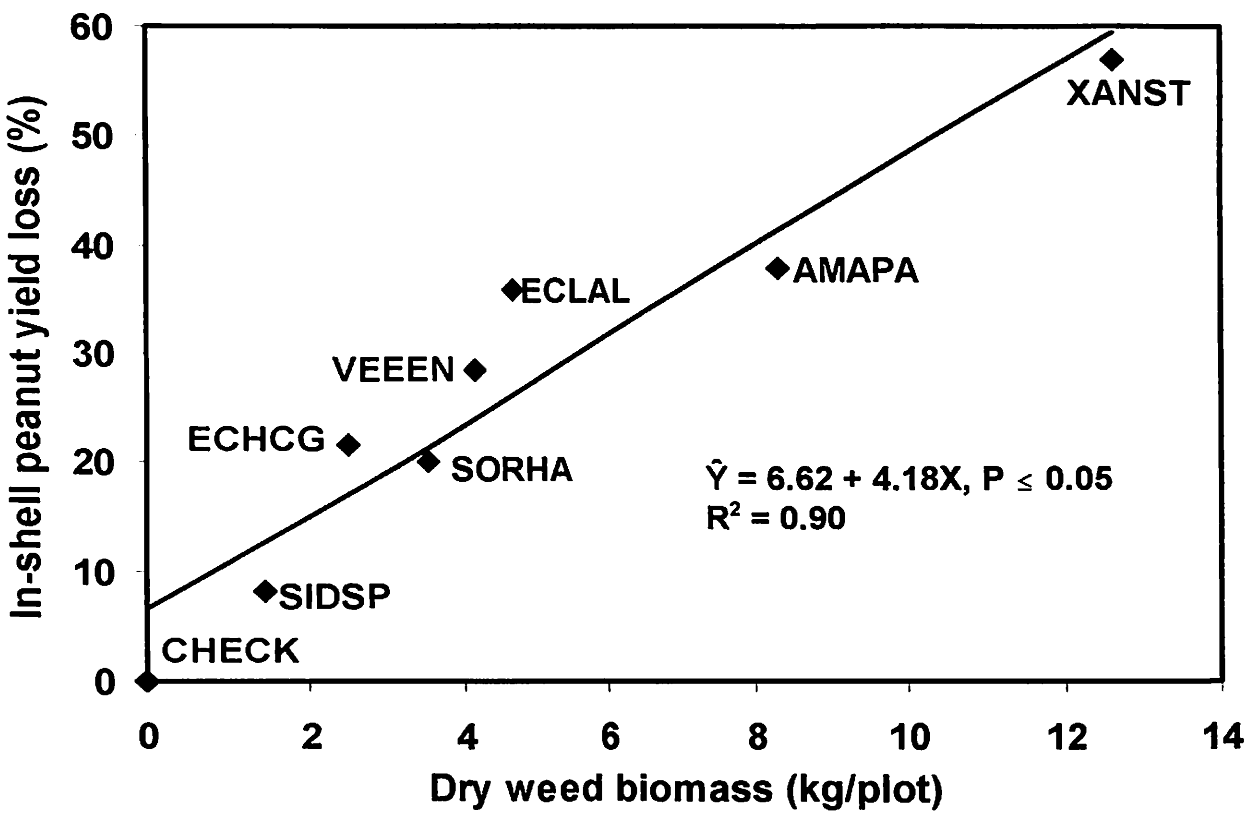

Figure 1. Relationship of in-shell peanut yield loss to dry weed biomass. Yield loss is expressed as a percentage of the weed-free check plots. Each data point represents the mean of eight plots from near Fort Cobb in 2002 and 2003 and is labeled with the Bayer code for that weed species.

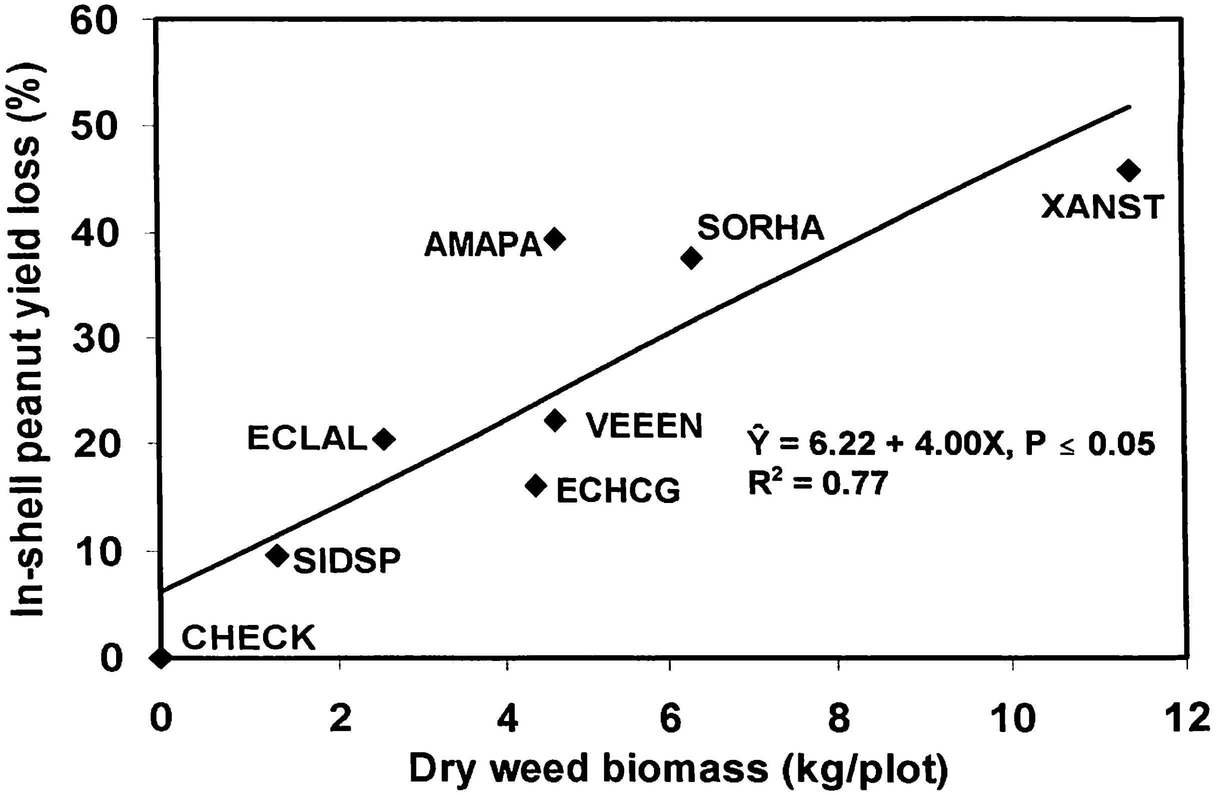

Figure 2. Relationship of in-shell peanut yield loss to dry weed biomass. Yield loss is expressed as a percentage of the weed-free check plots. Each data point represents the mean of four plots from near Perkins in 2002 and is labeled with the Bayer code for that weed species.

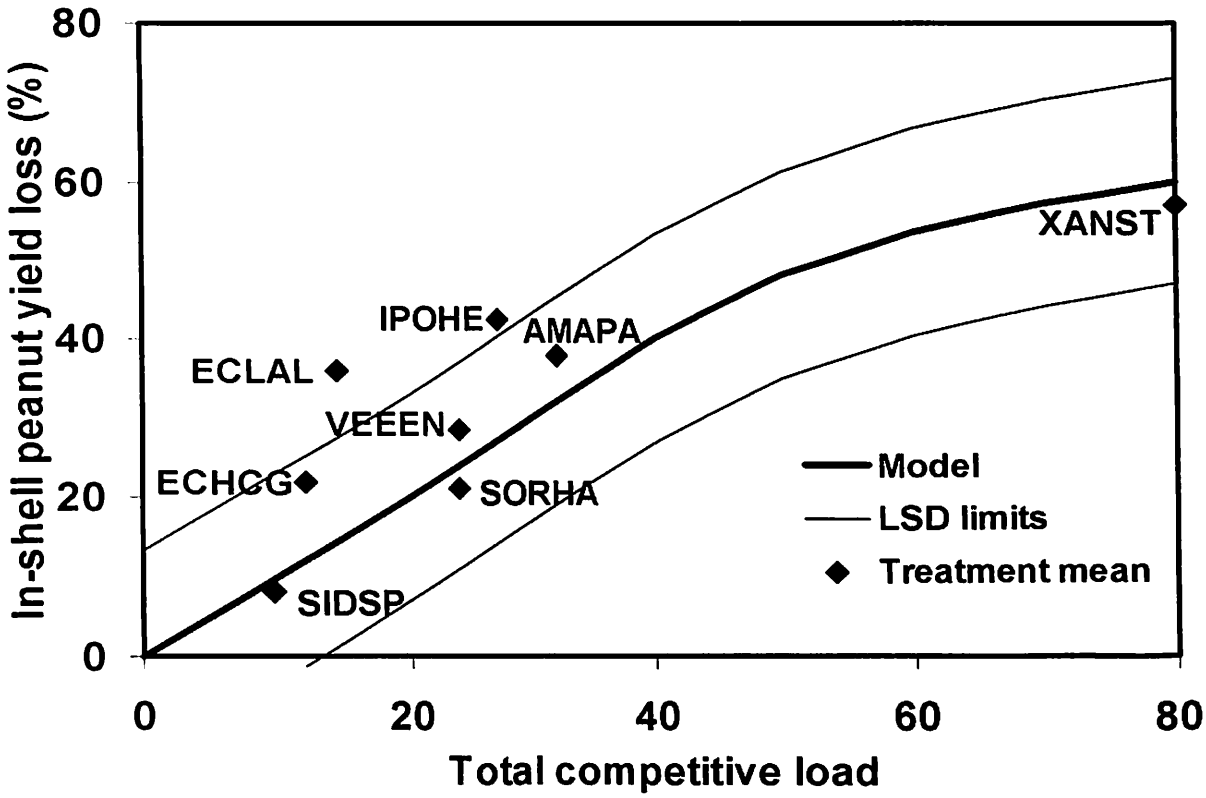

Figure 3. Comparison between actual vs. predicted in-shell peanut yield loss for each weed species. The protected LSD at the 0.05 probability level was 13.2%. Each data point represents the mean of eight plots from near Fort Cobb in 2002 and 2003 and is labeled with the Bayer code for that weed species.

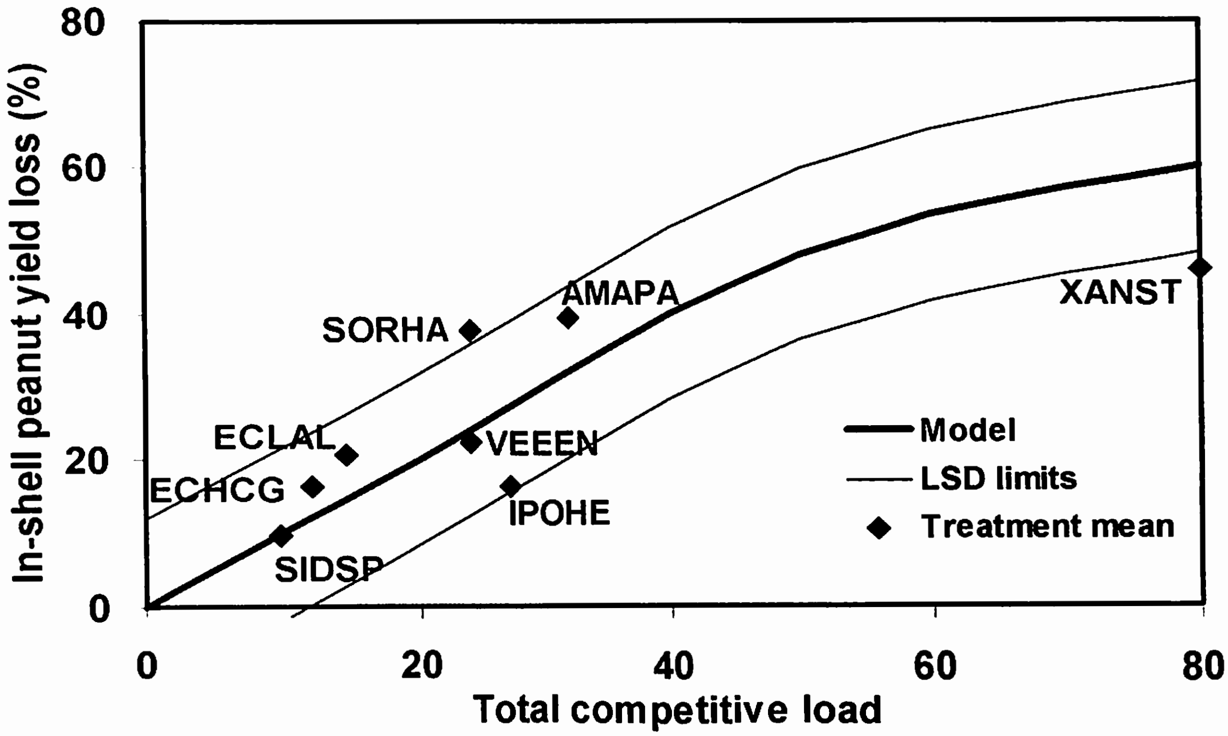

Figure 4. Comparison between actual vs. predicted in-shell peanut yield loss for each weed species. The protected LSD at the 0.05 probability level was 11.7%. Each data point represents the mean of four plots from near Perkins in 2002 and is labeled with the Bayer code for that weed species.

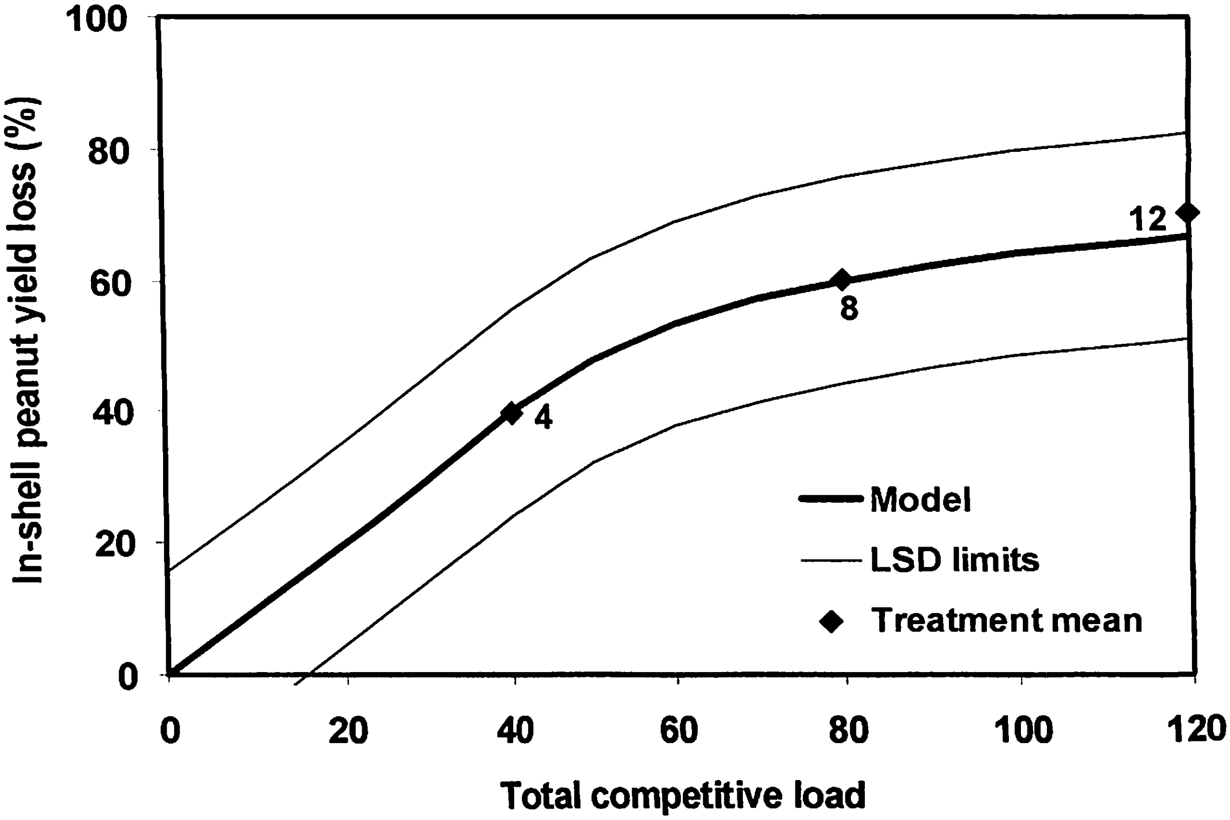

Figure 5. Comparison between actual vs. predicted in-shell peanut yield loss for three common cocklebur densities. The protected LSD at the 0.05 probability level was 15.6%. Each data point represents the mean of four plots from near Fort Cobb in 2003 and is labeled with the weed density/10 m of row.

APPENDIX

Appendix Table 1. Dry weed biomass of selected species near Fort Cobb, 2002 and 2003.

		Dry weed biomass								
		2002				2003				
		Replication								
Weed species	Weed density[a]	I	II	III	IV	I	II	III	IV	Mean
		kg/plot[b]								
Common cocklebur	4[c]	-	-	-	-	5.74	3.88	8.08	6.01	5.93
Common cocklebur	8	13.83	16.10	11.68	17.58	11.54	12.76	10.6	6.99	12.64
Common cocklebur	12[c]	-	-	-	-	12.45	15.34	12.14	12.00	12.98
Eclipta	8	4.42	3.18	4.88	6.58	4.46	6.02	4.22	3.58	4.67
Johnsongrass	8	4.31	7.14	4.54	4.31	2.26	2.08	0.98	2.54	3.52
Prickly sida	8	1.47	1.59	1.59	1.02	1.28	1.26	1.62	1.58	1.43
Ivyleaf morningglory[d]	8	-	-	-	-	-	-	-	-	-
Palmer amaranth	8	7.60	8.62	10.89	7.37	9.04	7.44	8.96	6.54	8.31
Crownbeard	8	2.61	3.18	3.74	2.38	6.22	5.16	6.64	3.36	4.16
Barnyardgrass	8	2.38	2.04	2.95	2.49	2.70	2.10	2.64	2.48	2.47
Check	0	0	0	0	0	0	0	0	0	0
Check	0	0	0	0	0	0	0	0	0	0

[a]Weed densities are based on one 0.91 m row, 10 m long.

[b]Harvested plot size was 1.82 m by 10 m.

[c]Treatments were included in 2003 only. Mean values for these treatments are based on the 2003 data only.

[d] Dry weed biomass for ivyleaf morningglory were not taken due to the viny growth habit of that weed.

Appendix Table 2. In-shell peanut yield response to selected weed species near Fort Cobb, 2002 and 2003.

		In-shell peanut yield								
		2002				2003				
		Replication								
Weed species	Weed density[a]	I	II	III	IV	I	II	III	IV	Mean
		kg/plot[b]								
Common cocklebur	4[c]	-	-	-	-	4.19	3.49	3.48	3.85	3.75
Common cocklebur	8	3.86	3.52	3.52	3.63	2.33	1.62	2.14	3.82	3.05
Common cocklebur	12[c]	-	-	-	-	1.75	2.27	1.52	1.90	1.86
Eclipta	8	6.46	6.24	5.56	5.22	3.38	3.10	3.74	2.97	4.58
Johnsongrass	8	7.03	5.22	5.22	6.80	3.73	6.06	6.34	3.81	5.53
Prickly sida	8	8.16	7.48	7.26	7.71	4.82	6.26	4.54	5.71	6.49
Ivyleaf morningglory	8	6.12	4.08	4.76	5.67	2.58	1.94	3.43	4.28	4.11
Palmer amaranth	8	4.65	5.22	4.76	4.76	3.90	4.11	3.12	4.34	4.36
Crownbeard	8	6.58	6.01	5.33	6.24	2.85	4.53	3.65	5.34	5.07
Barnyardgrass	8	7.26	6.46	6.35	6.24	3.19	5.77	4.27	4.78	5.54
Check	0	8.05	8.16	8.05	7.82	6.38	7.26	5.87	5.78	7.12
Check	0	7.82	7.82	7.14	7.37	6.34	6.18	6.39	5.68	6.84

[a]Weed densities are based on one 0.91 m row, 10 m long.

[b]Harvested plot size 1.82 m by 10 m.

[c]Treatments were included in 2003 only. Mean values for these treatments are based on the 2003 data only.

Appendix Table 3. Dry weed biomass of and in-shell peanut yield response to selected weed species near Perkins. 2002.

		Dry weed biomass					In-shell peanut yield				
		Replication					Replication				
Weed species	Weed density[a]	I	II	III	IV	Mean	I	II	III	IV	Mean
		kg/plot[b]									
Common cocklebur	8	12.93	12.93	10.55	9.19	11.40	4.08	3.86	3.40	2.61	3.49
Eclipta	8	2.38	2.15	2.04	3.63	2.55	5.67	5.22	5.44	4.20	5.13
Johnsongrass	8	7.48	5.44	7.26	5.22	6.35	3.18	4.42	3.52	4.99	4.03
Prickly sida	8	1.47	1.13	1.02	1.59	1.30	5.67	5.44	6.01	6.24	5.84
Ivyleaf morningglory[c]	8	-	-	-	-	-	5.22	5.56	5.44	5.44	5.41
Palmer amaranth	8	7.03	5.22	3.29	3.18	4.68	3.86	4.08	3.18	4.54	3.91
Crownbeard	8	4.20	3.86	4.08	6.46	4.65	5.10	4.65	5.22	5.10	5.02
Barnyardgrass	8	3.63	4.08	4.54	5.33	4.39	5.56	5.44	5.67	4.99	5.41
Check	0	0	0	0	0	0	7.03	6.24	6.35	6.58	6.55
Check	0	0	0	0	0	0	5.56	6.80	6.58	6.46	6.35

[a]Weed densities are based on one 0.91 m row, 10 m long.

[b]Harvested plot size was 1.82 m by 10 m.

[c]Dry weed biomass for ivyleaf morningglory were not taken due to the viny growth habit of that weed.

VITA (1)

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Master of Science

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