

**GRAIN SORGHUM HYBRID RESPONSE TO  
LASSO AND DUAL HERBICIDES AND  
EFFICACY OF SCREEN, CONCEP II, AND  
CONCEP II/APRON SEED SAFENERS**



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# GRAIN SORGHUM HYBRID RESPONSE TO LASSO AND DUAL HERBICIDES AND EFFICACY OF SCREEN, CONCEP II, AND CONCEP II/APRON SEED SAFENERS<sup>1</sup>

D. L. Wright, R. L. Vanderlip, D. L. Regehr,  
L. J. Moshier, and O. G. Russ<sup>2</sup>

## ABSTRACT

Greenhouse and field studies were conducted from 1987 to 1989 to determine sensitivity of 20 grain sorghum [*Sorghum bicolor* (L.) Moench.] hybrids to preplant incorporated treatments of 4.0 lb ai Dual/acre or 5.0 lb ai Lasso/acre. The safening abilities of Screen, Concep II, and Concep II plus Apron seed treatments were compared utilizing an unsafened control under greenhouse and field conditions. Analysis of variance revealed a significant year by hybrid by herbicide by seed safener interaction. Seed safeners did not slow seedling emergence in the no-herbicide treatments in the field or greenhouse. In general, Screen, Concep II, and Concep II/Apron prevented herbicide injury to all hybrids. However, some instances of seed safener failure occurred. These failures were not consistent to any seed safener, herbicide, or sorghum hybrid. Concep II and Screen provided reciprocal protection from Dual and Lasso injury. Apron, in combination with Concep II as a seed treatment, did not reduce the safening ability of Concep II. Although some differences in efficacy did occur among seed treatments, most differences were due to hybrid response. Use of seed safeners with Dual and Lasso is still recommended. Grain sorghum hybrids responded differently to application of Dual and Lasso herbicides and the response was inconsistent among years. Variation among hybrids used in this study was too great to recommend any as more tolerant of these herbicides. However, sound production practices can reduce the potential for injury from herbicides.

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<sup>1</sup>Contribution No. 91-586-B from the Kansas Agricultural Experiment Station.

<sup>2</sup>Former Research Assistant, Professor, Professor, Associate Professor, and Former Professor, respectively, Department of Agronomy, Kansas State University, Manhattan, KS 66506-5501.

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## INTRODUCTION

Kansas is one of the largest producers of grain sorghum [*Sorghum bicolor*(L.) Moench.] in the United States (Kansas Farm Facts, 1989) producing nearly 200 million bushels from over 3.7 million acres in 1989. One of the most important limitations to obtaining optimum yields in sorghum production is grassy weed control. In all crops, weeds compete for essential growth substances, such as water, nutrients, and light. The herbicides Lasso<sup>3</sup> and Dual<sup>4</sup> provide excellent grassy weed control in corn and soybeans but, when used on grain sorghum, may cause severe injury. The development of seed safeners for grain sorghum enabled growers to use Dual and Lasso to control problem grassy weeds and, at the same time, obtain optimal yields with minimal crop injury. Seed safeners are chemical additives that have limited phytotoxicity on their own and selectively protect crop plants against herbicide injury, without protecting any weeds. However, some grain sorghum hybrids have been shown to be sensitive to the application of seed safeners (Leif et al. 1987; Turner et al. 1982). In addition, previous research has shown a varietal response of many crops to the application of herbicides (Martin, 1985). Therefore, the possibility exists that grain sorghum hybrids may not perform as well when both herbicides and seed safeners are used in the production operation.

Seed safeners can be applied to the soil with the herbicide or directly to the crop seed. Concep II<sup>1</sup> is applied as a seed treatment to safen grain sorghum against injury from the herbicide Dual. Screen<sup>2</sup> is also applied as a seed treatment to grain sorghum and is labeled to safen it against injury from Lasso and Dual.

Diseases of sorghum also can limit yield. Fusarium stalk rot has become an increasingly serious problem as a root/stalk pathogen of sorghum. This disease is most serious during cool wet weather following hot, dry weather. The fungus thrives at soil temperatures below 68° F, which are too cold for rapid sorghum growth. It persists in the soil, on crop residue, and on some host weed species (U.S.D.A., 1975). Fusarium stalk rot has been shown to reduce seed filling and decrease seed weights by as much as 60 percent (U.S.D.A., 1975). Fusarium damage to seedling roots can limit uptake of essential growth elements, such as water and nutrients. During later stages of development, fusarium can destroy older roots, leaving the plant with little or no anchorage.

The fungicide Apron is being investigated as a seed treatment, applied in combination with Concep II, to control fusarium stalk/root rot in grain sorghum. Apron, whose chemical structure is similar to that of Dual, also has been reported to provide some protection against Dual injury to grain sorghum (Hatzios, 1989). However, that author suggested that the combination of two compounds of similar structure may cause an antagonistic effect and result in decreased efficacy of one or both of the compounds. Therefore, the addition of Apron with Concep II as a seed treatment may affect the ability of Concep II to safen grain sorghum against herbicide injury.

Field and greenhouse studies were conducted to determine if stand establishment and yield of sorghum hybrids vary in response to Dual and Lasso herbicides and if the addition of Apron to Concep II as a seed treatment affects its safening ability.

## MATERIALS AND METHODS

### Greenhouse Studies

Studies were initiated in 1987, 1988, and 1989 in a greenhouse located at Kansas State University, Manhattan, KS. They were designed with a three-factor treatment structure utilizing 20 grain sorghum hybrids, three herbicides, and four seed safener treatments. The studies had a split-split plot design with whole plots in a randomized complete block design with three replications. Replications were repeated in the same greenhouse over time. The whole plot consisted of a grain sorghum hybrid, the subplot of a herbicide treatment, and the sub-subplot of a seed safener treatment.

Seven seed companies contributed grain sorghum hybrids for this study. Hybrids utilized were as follows: Asgrow Chapparral and GS75311; DeKalb DK 18, DK 40, and DK 42Y; Funk's G550, HW3177, and HW7217; Golden

Harvest H501, H505, and H510; Northrup King 2656, 2778, and 9740Y; NC<sup>+</sup> 172, 174, and 271; and Pioneer 8358, 8493, and 8686.

New seed of each hybrid was obtained each year. One-pound samples of each hybrid were treated with seed safeners utilizing a Hege rotary seed treater. Screen (2.0 oz ai (active ingredient)/100 lb seed), Concep II (.0011 lb ai/lb seed), and Concep II/Apron (.0015 lb/lb seed) were applied as slurries with a 3 ml syringe using water as the diluent. An unsafened control treatment also was included.

The soil was a Reading silt loam (fine, mixed mesic, Typic Argiudoll) with 2.9% organic matter and pH 5.7. The soil was ground and sieved to eliminate clods. Temperatures for the greenhouse were maintained at 77 ± 40° F during daylight

<sup>3</sup> Registered trademark of Monsanto Company. Mention of a trademark or proprietary product does not imply approval by KAES to the exclusion of other products that also may be suitable.

<sup>4</sup> Registered trademark of CIBA-GEIGY Corp., Agricultural Division.

hours and  $68\pm 2^{\circ}\text{F}$  during nighttime hours. All experiments were performed between the months of November-March. Temperature variations in the greenhouse could not be minimized with the heating and cooling equipment available. Natural daylight was supplemented with sodium vapor lamps producing a minimum light intensity of approximately 5% of full sunlight with a daylength of 14 hours. Readings were taken with a Licor, model LI-185B, light meter using a 3.3 ft light bar placed at pot level approximately 4.9 ft below the lamps.

Herbicides were applied to the soil utilizing a moving-belt sprayer equipped with a stationary flat-fan nozzle delivering 20 gpa at 19 psi with water as the diluent. Lasso and Dual were applied separately at 5.0 lb ai/acre and 4.0 lb ai/acre, respectively, and incorporated. Two layers of paper towels were placed in the bottom of 8-inch diameter plastic pots to prevent soil loss through the drainage holes. Approximately 0.5 gal of untreated soil was placed in each pot. Two 1.0-inch layers of herbicide-treated soil, with 25 grain sorghum seeds placed between the layers, were placed on top of the untreated soil to simulate planting into a herbicide-treated zone of soil. Pots were sub-irrigated after planting and alternately sub- and top-irrigated as needed thereafter.

### Single-row Field Studies

Field studies were initiated in 1987, 1988, and 1989 at Kansas State University's Ashland Research Farm, near Manhattan, KS. The soil was a Reading silt loam (fine, mixed mesic, Typic Argiudoll) with 2.9% organic matter and pH 5.7. Sixty lbs. N/acre were broadcast over the plot area each year as ammonium nitrate. Furadan<sup>5</sup> as a 15% granule was applied in the furrow at 1.0 lb ai/acre each year.

These studies had a three-way treatment structure with a split-split plot design. Whole plots were planted to one sorghum hybrid and measured 30 ft by 20 ft in a randomized complete block design with three replications. Grain sorghum hybrids utilized in this study were identical to those in the greenhouse study. Subplots, to which the herbicide treatments were applied, measured 10 by 20 ft. The sub-subplot measured 30 inches by 20 ft, corresponding to one row of grain sorghum planted with a seed safener treatment. Subplot treatments were randomized within each whole plot, and sub-subplot treatments were randomized within each subplot.

Herbicide and seed safener treatments were identical to those in the previous study. Atrazine was applied postemergent to all plots at 2.0 lbs ai/acre, with crop oil concentrate at 1.0 qt./acre, for broadleaf weed control. The atrazine treatment did not affect the grain sorghum stand. Lasso and Dual were applied separately and incorporated on 14 May 1987, 26 May 1988, and 19 May 1989. Herbicides

Emergence dates were recorded when the coleoptile emerged through the soil surface. Pots with no seedling emergence were recorded as having 14 days to emergence, the maximum time that was recorded. Plant counts to determine seedling establishment were taken 20 days after planting. A seedling was designated as surviving the herbicide treatment if at least one leaf achieved collar formation. Leaf stage was recorded as the average of all surviving seedlings at 21 days after planting. Seedlings were harvested 21 days after planting and dried in an oven at  $150^{\circ}\text{F}$ . Total dry weight per pot was recorded. Dry weight per plant was calculated from the number of surviving seedlings.

The data were subjected to analysis of variance using the Statistical Analysis System (SAS Institute, 1985). Percent seedling emergence was analyzed utilizing the arc-sine transformation to stabilize variance. Mean separations were performed on the transformed data and assigned to the mean values. Means were separated utilizing Fisher's protected LSD with a 5% level of significance. A Hartley's  $F_{\max}$  test for homogeneity of variances among years was significant; therefore, each year's data were analyzed independently. Further analysis revealed a significant hybrid by herbicide by seed safener interaction; therefore, all means are reported.

were applied with a tractor-mounted sprayer delivering 20 gpa at 22 psi with water as the diluent. Sorghum was planted on 15 May 1987, 27 May 1988, and 20 May 1989. The study was planted with a four-row John-Deere MaxEmerge planter utilizing one row for each seed safener treatment. Seed safener treatments were allocated to a specific planter box to eliminate contamination among treatments. Planter boxes were thoroughly cleaned of seed between planting of different hybrids. Plant populations were not uniform among hybrids because of seed size differences.

Emergence dates were recorded when the coleoptiles of the first seedlings emerged through the soil surface. Plant stands were recorded at the 2-leaf stage of development. Bloom dates were recorded when plants reached the half-bloom stage, as outlined by Vanderlip (1979). Head counts, including those from tillers, were taken approximately 3 weeks after plants had reached the half-bloom stage. Plots with no emerged plants were recorded as having 14 days to emergence and zero plants/foot.

The data were subjected to analysis of variance using the Statistical Analysis System (SAS Institute, 1985). The analysis revealed a significant interaction of year with all variables; therefore, the means were separated by year. Means were separated utilizing Fisher's protected LSD with a 5% level of significance. Data for days to half-bloom and heads/ft were not taken in 1989 because of severe drought conditions.

<sup>5</sup>Registered trademark of FMC Corporation.

## Yield Field Studies

Field studies were initiated in 1988 and 1989 at Kansas State University's Ashland Research Farm, near Manhattan, KS. The study was conducted on a Muir silt loam, (fine-silty, mixed, mesic, Pachic Haplustoll) with 2.3% organic matter and pH 5.9. Sixty lbs. N/acre were broadcast over the plot area as ammonium nitrate in 1988 and 72 lbs. N/acre in 1989. Furadan was applied in the furrow at 1.0 lb. ai/acre in both years.

Ten hybrids were used in this study: Asgrow GS75311; DeKalb 42Y; Funk's G550 and HW7217; Golden Harvest H505 and H510; Northrup King 9740Y; NC<sup>+</sup> 174 and 172; and Pioneer 8686. These hybrids were selected on the basis of stand establishment in the 1987 single-row field study from unsafened seed in herbicide-treated plots. Funk's G550, Funk's HW7217, Northrup King 9740Y, NC<sup>+</sup> 172, and NC<sup>+</sup> 174 had stand establishment exceeding 60% of that in the no-herbicide plots and are described as tolerant hybrids. Stand establishment of the remaining five hybrids was below 60%, and they are described as susceptible.

Concep II, Screen, Lasso, and Dual were applied as described in the previous section. Herbicides were applied and incorporated on 2 June 1988 and 25 May 1989. Herbicides were applied with a tractor-mounted spray boom delivering 20 gpa at 22 psi. Grain sorghum was planted on 4 June 1988 and 26 May 1989. Planting was delayed in 1988 by rainfall immediately af-

ter herbicide application. Atrazine was applied on all plots as previously described. The plot area was irrigated as needed with a lateral move, overhead-sprinkler, irrigation system applying 3.0 inches of water per event.

The study was a split plot design with whole plot treatments in a randomized complete block design with three replications. Subplot treatments were randomized within each whole plot. Whole plot treatments consisted of one grain sorghum hybrid planted in a plot measuring 50 ft by 30 ft. Subplot treatments consisted of an herbicide plus seed safener treatment combination. Subplot treatments were planted in four-row plots measuring 10 ft by 30 ft, with rows spaced 30 inches apart

Emergence dates, stand counts, and head counts were recorded following the procedures outlined above. Plots with no seedling emergence were recorded as having 14 days to emergence and zero plants/foot. Plots were harvested with a modified two-row Gleaner E combine. Plot yield (adjusted for moisture) and test weight were determined, and seeds per head and seed weight were calculated from grain yield, head number, and seed weight.

The data were subjected to analysis of variance using the Statistical Analysis System (SAS Institute, 1985). Means were separated utilizing Fisher's protected LSD with a 5% level of significance.

## RESULTS AND DISCUSSION

An initial analysis was performed on the Screen, Concep II, and Concep II/Apron treatments only. This analysis revealed a significant hybrid by herbicide by seed safener interaction for days to emergence, percent emergence, and leaf stage. Differences among safener treatments were not specific to any hybrid, herbicide, or seed safener treatment. This

indicates that classification of one seed safener as superior may not be possible. A subsequent analysis included all seed safener treatments. The analysis again revealed a significant hybrid by herbicide by seed safener interaction for days to emergence, percent emergence, and leaf stage. The results below are from the latter analysis.

### Greenhouse Study 1987

Seed safeners did not slow seedling emergence of any hybrid in the no-herbicide pots (Tables 1-20). Concep II, Screen, and Concep II/Apron protected all hybrids against injury from Dual and Lasso herbicides. Some differences in safening ability occurred among the Concep II, Screen, and Concep II/Apron treatments. Concep II and Concep II/Apron provided less protection of some hybrids when compared to Screen. Seedling establishment in herbicide-treated soil varied among hybrids when grown from safened seed. Sensitivity of grain sorghum hybrids to Dual and Lasso also varied. Five hybrids (Funk's HW7217, Funk's G550, Northrup King 9740Y, NC<sup>+</sup> 172, and NC<sup>+</sup> 174) showed greater than 60% seedling establishment from unsafened seed in herbicide-treated soil. Seedling establishment of NC<sup>+</sup> 271 exceeded 40%. Subsequent analysis revealed that seed of Funk's G550, Funk's HW7217, and NC<sup>+</sup> 172 was contami-

nated with Concep II (<.70 g/kg). It is unlikely that this amount of contamination would have sufficient safening ability against twice-normal use rates of Dual and Lasso. However, this contamination may have contributed to the resultant stand. Nevertheless, hybrids shown to be safener-free had similar stands. Seedling establishment of unsafened grain sorghum in herbicide-treated soil has been reported previously. Ketchersid et al. (1981) observed no injury to unsafened grain sorghum when the soil surface remained dry up to seedling emergence. However, all pots in this study were sub-irrigated to the point of surface saturation. Both Dual and Lasso reduced seedling establishment of the remaining 14 hybrids when unsafened seed was used. Severe stand reduction of unsafened grain sorghum by herbicides such as Dual and Lasso also has been reported previously (Muller and Nyffeler, 1981; Nyffeler et al., 1980).

Seed safeners did not affect seedling development in the no-herbicide pots, as measured by leaf stage (Tables 1-20). Dual and Lasso delayed development of unsafened grain sorghum. Seedlings from unsafened seed had fewer fully developed leaves 21 days after planting. Severely injured seedlings were stunted and generally did not exceed the two-leaf stage (Tables 1-20). Among hybrids that survived the herbicide

treatment, leaf stage of seedlings grown from unsafened seed was not significantly different from that of seedlings grown from safened seed.

Lasso and Dual significantly reduced plant dry weight (averaged across hybrids) when compared to the no-herbicide treatment (Table 21). However, Lasso reduced plant dry weight significantly more than Dual.

## Greenhouse Study 1988

Concep II, Screen, and Concep II/Apron safened most hybrids against injury from Lasso and Dual. However, seed safeners failed to provide protection to some hybrids (Tables 3, 8, 10, 11, 13). In these instances, failures were not specific to either herbicide.

Hybrids that exceeded 60% seedling establishment from unsafened seed in 1987 were severely injured in 1988. In

contrast, two hybrids that were severely injured in 1987 had excellent seedling establishment in 1988. Seedling establishment of unsafened Pioneer 8358 and Pioneer 8493 seed grown in herbicide-treated soil was not significantly different from that of either Screen- or Concep II-treated seed (Table 18). However, subsequent analysis of seed of these hybrids revealed that the seed had been inadvertently safened with Concep II.

## Greenhouse Study 1989

Overall protection from Concep II, Screen, and Concep II/Apron seed treatments was good. However, both Dual and Lasso reduced seedling establishment from safened seed. Seedling establishment varied among hybrid, herbicide, and seed safener treatments.

Lasso and Dual reduced weight of seedlings grown

from unsafened seed (Table 21). Dual reduced weight of seedlings grown from Concep II/Apron-safened seed when compared to Screen-safened seed. However, the safening ability of Concep II and Concep II/Apron was equal. Likewise, Screen and Concep II provided equal protection of sorghum seedlings against Dual and Lasso injury.

## Single-row Field Study 1987

Days from planting to emergence of sorghum seedlings varied with year, hybrid, herbicide, and seed safener treatment (Tables 22-41). Lasso and Dual delayed emergence of unsafened seedlings. Delays in emergence of 1 day or more were significant. Seed safeners did not delay emergence of seedlings in the no-herbicide plots.

Concep II, Screen, and Concep II/Apron effectively safened all hybrids against injury (stand reduction) from Dual and Lasso. Although some differences in efficacy among Screen, Concep II, and Concep II/Apron did occur (Tables 25, 26, 27, 32, 35, 36, 37, 40), all seed safeners provided good protection against herbicide injury. Percent seedling establishment after an herbicide application was inconsistent among years and varied with grain sorghum hybrid and seed safener treatment. Seedling establishment

of most hybrids was reduced severely by herbicides when they were planted without a seed safener. However, seedling establishment from unsafened seed did occur in some plots. Five grain sorghum hybrids showed seedling establishments from unsafened seed exceeding 60% of that in herbicide-treated plots: Funk's G550 and HW7217; Northrup King 9740Y; NC<sup>+</sup> 172 and 174. Seed of hybrids used in this study was from the same samples used in the 1987 greenhouse study.

Maturity of eight of the 20 sorghum hybrids grown from Screen-treated seed was significantly delayed by an herbicide application (Table 42). Maturity of Screen-safened seed was delayed by both Lasso and Dual (Table 43). However, maturity was not delayed when seeds were safened with Concep II or Concep II/Apron.

## Single-row Field Study 1988

In some instances, seedlings grown from unsafened seed emerged significantly later than seedlings grown from safened seed in the no-herbicide plots (Tables 23, 37, 38). Delayed emergence in these plots may have been due to the proximity of the unsafened seed-row to the herbicide in adjacent plots and not to enhanced emergence by the safener. Seedling emergence of most hybrids was delayed when unsafened seed was planted in herbicide-treated plots. Funk's HW7217 and

NC<sup>+</sup> 271 were exceptions (Tables 29, 35).

All seed safeners provided excellent protection of grain sorghum against injury from Dual and Lasso. Some differences in efficacy among seed safeners did occur. However, these differences were not specific to a hybrid or herbicide treatment. Seedling establishment of unsafened Funk's HW7217 seed exceeded 60% of that in the no-herbicide plots (Table 29). These results are consistent with those of the 1987 single-row study.

## Single-row Field Study 1989

Screen did not safen some grain sorghum hybrids against herbicide injury (Tables 24, 26, 31, 33, 37). This effect was also observed in other trials throughout Kansas during 1989 (D. Jardine, 1991, personal communication).

Results for the hybrid Northrup King 9740Y were

similar to those obtained in 1988. Seedling establishment from unsafened Asgrow GS75311 seed in herbicide-treated plots was 70% of that in the no-herbicide plots. Stands from this hybrid had been reduced severely in previous years. In addition, results from NC<sup>+</sup> 174 were similar to those observed in 1987.

## Comparison of Results for 1987, 1988, and 1989

Four grain sorghum hybrids showed seedling establishments from unsafened seed in herbicide-treated plots exceeding 60% of those in the no-herbicide plots in 2 of the 3 years. This indicates that some mechanism, either environmental or physiological, may be influencing the response of these hybrids to the herbicides Lasso and Dual. Temperature and moisture influence the effectiveness of seed safeners. It is likely that these factors also influence herbicide injury when seed safeners are not present.

The variability in the results between field and greenhouse studies may have been due to higher levels of soil moisture during the 4- to 7-day emergence period in the greenhouse studies. High soil moisture contents from rainfall or irrigation during this period have been shown to increase injury from Lasso and Dual (Ketchersid et al. 1981; Devlin et al. 1983). The drought that began in 1987 resulted in low available soil moisture before and after planting. Rainfall totaled 0.7 inch during the 7-day period prior to planting. Because of the extremely dry soil conditions and moisture evaporation after plot preparation, a 0.7 inch rainfall may not have been enough to induce severe herbicide injury. Rainfalls at 3 and 7 days after planting totaled 0.3 and 0.9 inch, respectively. Seedlings of most hybrids emerged 5 days after planting; thus, the 0.9 inch rainfall would have been too late to induce herbicide injury. However this does not explain the dramatic differences observed among grain sorghum hybrids.

Drought conditions were more severe in 1988 than in 1987. Rainfall totaled 0.04, 0.4, 0.08, and 0.12

inch, at 3, 5, 6, and 7 days after planting, respectively. Minimal rainfall should have resulted in less injury to sorghum seedlings. However, hybrids that showed seedling establishments from unsafened seed in excess of 60% after an herbicide application in 1987 did not show the same results in 1988. In 1989, herbicides were applied and seeds were planted into extremely dry soil. Approximately 24 hours after planting, a 0.6 inch rain fell. This rainfall, along with the available soil moisture, may have induced herbicide injury.

Even though seedling establishment from unsafened seed and safened seed in some herbicide-treated plots was not significantly different, seedling emergence was delayed. These delays were not consistent between Lasso or Dual treatments. Differences among years for time from planting to emergence may have been due to differences in soil moisture or temperature. Data for these environmental factors were not taken.

Head numbers of most grain sorghum hybrids in 1987 and 1988 were decreased by Lasso and Dual when plants were grown from unsafened seed (Tables 22-41). Differences in head numbers among hybrids may have been due to differences in tillering ability, which was not considered during the design of these experiments. In plots with greatly reduced stands, surviving plants were unable to compensate through tillering. In contrast, no differences in head number occurred in plots with moderate stand reduction because of compensation through tillering.

## Yield Field Studies 1988 and 1989

Sorghum hybrids were described as tolerant or susceptible by the results of the 1987 single-row study. Tolerant hybrids included Funk's G550, Funk's HW7217, Northrup King 9740Y, NC<sup>+</sup> 174, and NC<sup>+</sup> 172. Five hybrids were selected at random from the susceptible group: DeKalb 42Y, Golden Harvest H501 and H510, Pioneer 8686, and Asgrow GS75311.

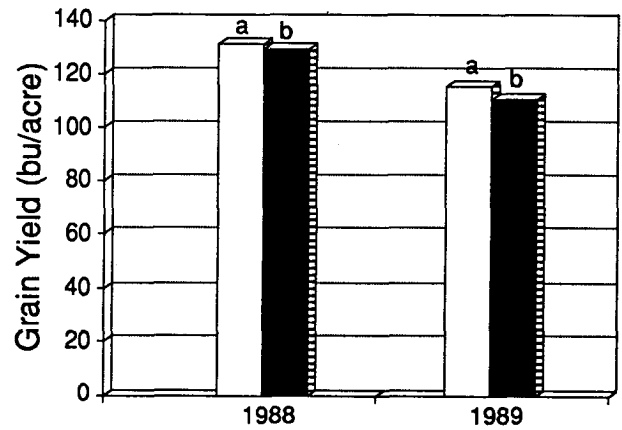
In both years, seedling establishment was not significantly different between tolerant and susceptible hybrids in no-herbicide plots planted with unsafened seed (Figure 1). Tolerant and susceptible hybrids also showed nearly equal seedling establishments from safened seed in

herbicide-treated plots. However, unsafened seed of tolerant hybrids provided greater seedling establishments than susceptible hybrids in herbicide-treated plots. Seedling establishment from unsafened seed was greater in Dual-treated plots than in Lasso-treated plots,

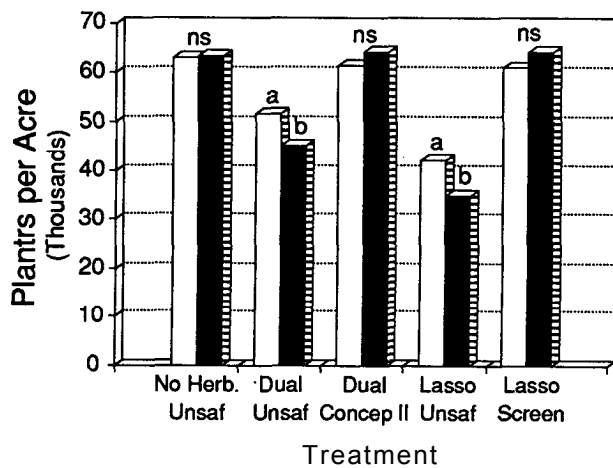
Susceptible hybrids had greater numbers of heads when herbicides were applied to soil planted with unsafened seed in 1988 and 1989. However, susceptible hybrids also had greater numbers of heads in the no-herbicide plots (Figure 2). This suggests that the susceptible hybrids may have a greater tillering ability. It also diminishes the impact of increased head number in herbicide-treated plots.



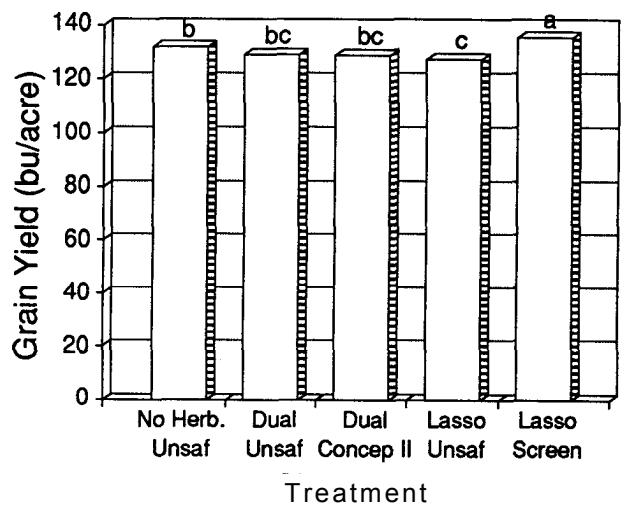
Grain yield of tolerant hybrids was significantly greater than that of susceptible hybrids in both 1988 and 1989 (Figure 3). Differences among the herbicide/safener treatments occurred as well. In 1988, application of Lasso to plots planted with Screen-treated seed resulted in higher grain yield than any other treatment. Application of Lasso or Dual to plots planted with unsafened seed reduced grain yield similarly (Figure 4). Yields from plots treated with Dual were equal when planted with unsafened seed and Concep II-treated seed. In addition, grain yields were not different from plots planted with unsafened seed and sprayed with Dual and from the no-herbicide plots. In 1989, however, application of an herbicide to plots planted with unsafened seed reduced grain yield (Figure 5).



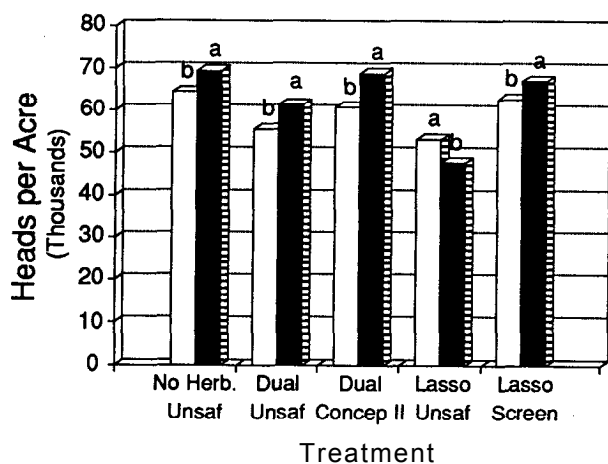
**Figure 3.** Effects of Lasso (5.0 lb ai/acre) and Dual (4.0 lb ai/acre) on grain yield of sorghum when averaged across the unsafened, Concep II-safened, and Screen-safened treatments in 1988 and 1989 in the field at Manhattan, KS. White bars = tolerant hybrids; black bars = susceptible hybrids.



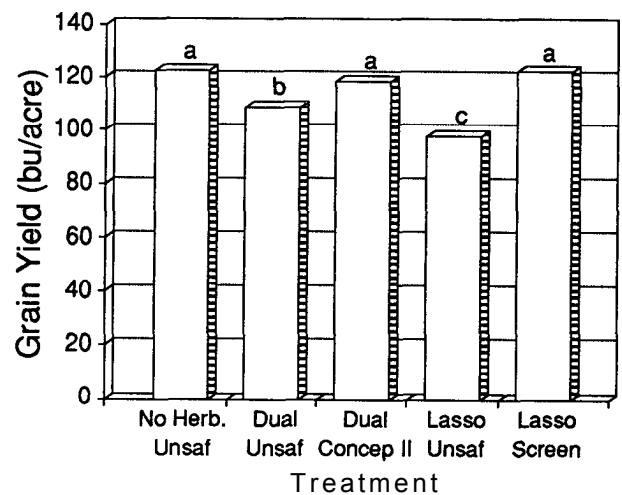
**Figure 1.** Effects of Lasso (5.0 lb ai/acre) and Dual (4.0 lb ai/acre) on plants per acre of unsafened, Concep II-safened, and Screen-safened grain sorghum in 1988 and 1989 in the field at Manhattan, KS. White bars = tolerant hybrids; black bars = susceptible hybrids.



**Figure 4.** Effects of Lasso (5.0 lb ai/acre) and Dual (4.0 lb ai/acre) on grain yield of unsafened, Concep II-safened, and Screen-safened grain sorghum in 1988 in the field at Manhattan, KS.



**Figure 2.** Effects of Lasso (5.0 lb ai/acre) and Dual (4.0 lb ai/acre) on heads per acre of unsafened, Concep II-safened, and Screen-safened grain sorghum in 1988 and 1989 in the field at Manhattan, KS. White bars = tolerant hybrids; black bars = susceptible hybrids.



**Figure 5.** Effects of Lasso (5.0 lb ai/acre) and Dual (4.0 lb ai/acre) on grain yield of unsafened, Concep II-safened, and Screen-safened grain sorghum in 1989 in the field at Manhattan, KS.

## Summary

Screen, Concep II, and Concep II/Apron were effective in safening grain sorghum against injury from Dual and Lasso throughout the three years of this study. Concep II and Screen provided reciprocal protection from Dual and Lasso. The combination of Apron with Concep II as a seed treatment did not reduce the safening ability of Concep II. Although some differences in efficacy did occur among seed treatments, most differences were due to hybrid response. Grain sorghum hybrids responded differently to application of Dual and Lasso herbicides, and the response was inconsistent among years.

The designations of tolerant or susceptible given to hybrids after the 1987 field and greenhouse studies are probably inaccurate. Hybrids termed tolerant after the 1987 field study did not show consistent results among the years of this study. The ability to plant a hybrid that is less severely injured by these herbicides would provide some assurance to growers that they can achieve optimal yields. However, it is impossible

to make reliable recommendations on which hybrid would suit this purpose because of the variability in hybrid response in this study. Differences in hybrid response among years may be explained by differences in environmental conditions. However, there is no satisfactory explanation for the vast differences in sorghum hybrid response within each year. Therefore, a recommendation for the use of Lasso and Dual herbicides in grain sorghum without seed safeners is unforeseeable.

Sound production practices such as use of high quality, high protein, sorghum seed and planting in soils with temperatures greater than 68°F would provide optimal growing conditions for the developing seedling. These conditions may help reduce the potential for, but would not eliminate, injury from Dual and Lasso herbicides. In addition, delaying irrigation until after the sorghum seedlings have emerged also would help reduce the potential for injury from these herbicides.

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**Table 1. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Asgrow Chaparral grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	95a	4.2a	146	6.0a	72b	3.7a	95a	5.0a	87a	3.3a	80
Screen	6.0a	88ab	3.6a	120	6.0a	72b	3.3a	75a	5.0a	60b	3.0a	63
Concep II	6.0a	80b	4.3a	155	7.0a	64b	3.7a	75a	5.0a	81ab	3.0a	62
Concep II/Apron	6.0a	91ab	4.3a	180	6.0a	92a	4.0a	89a	7.0a	75ab	3.0a	56
Dual												
Unsafened	11.0a	4b	1.0b	27	14.0a	0b	0.0b	0b	10.0a	2b	0.0c	0
Screen	6.0b	80a	4.3a	152	8.0b	45a	3.0a	36a	8.0ab	69a	3.0a	32
Concep II	6.0b	85a	4.3a	125	8.0b	52a	3.0a	39a	6.0b	67a	2.3ab	29
Concep II/Apron	7.0b	95a	4.0a	104	7.0b	60a	2.7a	43a	9.0a	57a	2.0b	22
Lasso												
Unsafened	14.0a	0b	0.0b	0	14.0a	0c	0.0b	0b	10.0a	1b	0.7b	0
Screen	7.0b	77a	4.4a	96	10.0b	43ab	2.7a	20ab	10.0a	45a	2.7a	21
Concep II	6.0b	89a	3.6a	88	7.0c	55a	2.7a	34a	9.0a	41a	2.0a	23
Concep II/Apron	7.0b	89a	4.0a	104	10.0b	29b	2.3a	28ab	8.0a	25a	2.3a	17

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 2. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Asgrow GS75311 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a	85a	3.7a	187	9.0a	52a	3.3a	93b	7.0a	75a	3.0a	55
Screen	6.0a	88a	4.0a	168	7.0b	53a	4.0a	92b	5.0a	77a	3.0a	55
Concep II	6.0a	88a	4.0a	176	6.0b	53a	4.0a	136a	5.0a	61a	3.0a	57
Concep II/Apron	6.0a	92a	3.7a	161	7.0b	63a	3.3a	81b	5.0a	68a	3.3a	67
Dual												
Unsafened	14.0a	5b	1.2b	90	14.0a	0c	0.0b	0b	8.0a	28b	1.3b	19
Screen	6.0b	81a	3.8a	137	8.0b	56a	2.7a	44a	8.0a	57a	2.7a	36
Concep II	7.0b	80a	3.7a	116	9.0b	35ab	2.7a	24ab	8.0a	51a	2.3a	33
Concep II/Apron	7.0b	57a	3.9a	96	9.0b	27b	2.3a	30ab	8.0a	44ab	2.3a	33
Lasso												
Unsafened	14.0a	0c	0.0b	0	14.0a	0b	0.0b	0b	12.0a	25a	1.3b	22
Screen	6.0b	88a	3.7a	87	8.0c	47a	3.0a	40a	9.0b	64ab	2.7a	33
Concep II	7.0b	69b	4.2a	117	8.0c	43a	2.7a	31a	9.0b	49b	2.3a	23
Concep II/Apron	7.0b	68b	3.5a	93	10.0b	23a	2.3a	26ab	10.0ab	45a	2.0ab	25

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 3. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to DeKalb 18 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	88a	4.3a	183	7.0a	48a	3.3a	73a	5.0a	79a	3.3a	65
Screen	5.0a	95a	4.5a	177	8.0a	43a	3.3a	62a	5.0a	89a	3.3a	48
Concep II	6.0a	84a	4.2a	173	7.0a	41a	3.0a	82a	5.0a	83a	3.0a	59
Concep II/Apron	6.0a	88a	4.7a	195	7.0a	48a	3.0a	63a	5.0a	88a	3.3a	57
Dual												
Unsafened	14.0a	0c	0.0b	0	14.0a	0b	0.0c	0b	9.0a	0c	0.0b	0
Screen	6.0b	93a	4.3a	125	8.0c	15a	2.7a	37a	6.0b	72a	2.7a	31
Concep II	7.0b	59b	3.8a	104	10.0b	8ab	1.3b	16ab	6.0b	35b	2.0a	22
Concep II/Apron	7.0b	59b	4.2a	129	11.0b	8ab	2.0ab	11ab	9.0a	13c	0.7b	36
Lasso												
Unsafened	13.0a	1c	1.0b	140	14.0a	0b	0.0b	0b	9.0a	0c	0.0b	0
Screen	7.0b	93a	4.2a	94	10.0b	20a	2.3a	35a	8.0a	64a	2.7a	33
Concep II	7.0b	65b	3.8a	99	14.0a	0b	0.0b	0b	8.0a	41ab	2.7a	37
Concep II/Apron	7.0b	73b	4.0a	75	11.0b	7b	2.0a	15ab	8.0a	31b	2.0a	41

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 4. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to DeKalb 40 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	88a	4.3a	165	7.0b	79a	3.7a	94a	5.0b	84a	3.3a	55
Screen	6.0a	89a	4.0a	128	7.0b	67ab	3.3ab	66a	8.0a	77a	3.0a	46
Concep II	6.0a	83a	3.9a	174	7.0b	60b	3.3ab	94a	7.0ab	91a	3.0a	44
Concep II/Apron	5.0a	89a	4.0a	179	9.0a	63ab	2.7b	65a	5.0b	85a	3.3a	82
Dual												
Unsafened	14.0a	3c	1.2b	105	14.0a	0c	0.0b	0b	12.0a	0b	0.0c	0
Screen	6.0c	79a	4.0a	108	9.0b	73a	3.0a	43a	8.0b	75a	2.7a	31
Concep II	8.0b	56b	3.5a	85	9.0b	31b	2.7a	24ab	11.0a	3b	1.7b	100
Concep II/Apron	8.0b	64ab	3.5a	97	9.0b	27b	2.3a	29ab	12.0a	4b	1.3b	13
Lasso												
Unsafened	12.0a	1c	2.0b	0	14.0a	0b	0.0b	0b	12.0a	0c	0.0c	0
Screen	7.0b	81a	4.0a	90	10.0b	43a	2.3a	30ab	8.0b	76a	2.7a	26
Concep II	8.0b	73a	3.3a	81	11.0b	28a	2.3a	35a	8.0b	52ab	2.3ab	39
Concep II/Apron	8.0b	51b	4.0a	90	10.0b	32a	2.3a	19ab	10.0b	32b	1.7b	19

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 5. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to DeKalb 42Y grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	79a	3.8a	208	7.0a	76a	3.0bc	75ab	5.0c	63a	3.0ab	54
Screen	6.0a	64a	4.0a	150	7.0a	57a	4.0a	102a	6.0bc	61a	2.3b	44
Concep II	6.0a	83a	3.7a	130	7.0a	71a	3.3ab	79ab	8.0ab	69a	2.7ab	50
Concep II/Apron	6.0a	75a	4.2a	160	7.0a	57a	2.3c	57b	10.0a	67a	3.3a	55
Dual												
Unsafened	14.0a	1c	0.7b	10	14.0a	0c	0.0c	0b	14.0a	0c	0.0c	0
Screen	7.0b	77a	3.8a	89	8.0c	55a	3.0a	44a	10.0c	69a	2.3a	22
Concep II	8.0b	52b	4.0a	122	9.0c	37b	2.3ab	23ab	13.0ab	24b	1.3b	20
Concep II/Apron	8.0b	41b	3.8a	90	12.0b	11a	1.7b	12b	11.0bc	3bc	2.0ab	135
Lasso												
Unsafened	14.0a	0b	0.0b	0	14.0a	0b	0.0b	0b	14.0a	0c	0.0c	0
Screen	7.0b	75a	4.3a	102	9.0c	49a	2.7a	37a	8.0b	67a	2.7a	35
Concep II	7.0b	75a	3.8a	83	11.0b	48a	2.0a	15a	9.0b	36b	2.0ab	16
Concep II/Apron	8.0b	61a	3.8a	93	10.0bc	31a	2.3a	38a	10.0b	13bc	1.7b	8

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 6. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Funk's HW3177 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	93a	4.0a	190	6.0a	77a	3.3a	93b	5.0a	85a	3.7a	90
Screen	6.0a	93a	4.2a	162	7.0a	72a	4.0a	88b	5.0a	81a	3.7a	63
Concep II	5.0a	91a	4.0a	154	7.0a	69a	4.0a	106ab	5.0a	83a	3.0a	55
Concep II/Apron	5.0a	88a	4.0a	172	6.0a	73a	4.0a	111a	5.0	89a	3.0a	58
Dual												
Unsafened	14.0a	5b	1.3b	55	14.0a	0c	0.0b	0b	12.0a	1c	0.3c	0
Screen	6.0b	93a	3.7a	111	7.0c	44b	3.0a	47a	6.0b	68a	2.7a	42
Concep II	6.0b	95a	4.0a	106	7.0c	72a	3.0a	56a	6.0b	55a	2.7a	35
Concep II/Apron	6.0b	85a	3.7a	134	9.0b	51ab	3.3a	36a	11.0a	21b	1.7b	12
Lasso												
Unsafened	14.0a	0b	0.0b	0	14.0a	0c	0.0b	0b	12.0a	0b	0.0b	0
Screen	6.0b	97a	3.8a	106	10.0b	33b	2.7a	33a	8.0bc	47a	3.0a	28
Concep II	6.0b	95a	4.0a	115	9.0bc	53ab	3.0a	37a	9.0b	57a	3.0a	26
Concep II/Apron	6.0b	92a	4.0a	140	8.0c	56a	2.7a	25a	6.0c	45a	2.7a	32

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 7. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Funk's HW7217 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	95a	4.0a	163	6.0a	88a	3.3a	83a	5.0a	99a	3.0a	41
Screen	6.0a	95a	4.0a	170	7.0a	80a	3.3a	102a	5.0a	97a	3.0a	51
Concep II	6.0a	91a	3.7a	154	7.0a	88a	3.3a	112a	5.0a	93a	3.0a	58
Concep II/Apron	6.0a	93a	3.7a	123	7.0a	75a	3.7a	102a	5.0a	97a	3.0a	78
Dual												
Unsafened	8.0a	60b	4.0a	95	11.0a	7b	1.7b	23a	11.0a	4b	1.3a	35
Screen	6.0b	87a	4.3a	145	8.0b	76a	3.0a	51a	8.0b	47a	2.0a	27
Concep II	6.0b	91a	4.0a	132	8.0b	76a	3.0a	51a	7.0b	41a	2.0a	45
Concep II/Apron	6.0b	93a	4.0a	132	9.0b	44a	2.3ab	25a	7.0b	53a	2.0a	28
Lasso												
Unsafened	8.0a	65b	3.5a	74	11.0a	17b	2.3a	16a	9.0b	2b	1.0a	0
Screen	6.0b	88a	4.3a	121	9.0b	67a	2.7a	33a	9.0b	43a	1.7a	19
Concep II	7.0ab	85a	3.7a	106	9.0b	45a	2.3a	36a	13.0a	20a	1.7a	14
Concep II/Apron	6.0b	88a	4.0a	117	11.0a	28a	2.3a	28a	11.0ab	17ab	1.7a	8

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 8. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Funk's G550 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	83a	3.8a	134	7.0bc	55a	3.3ab	97b	5.0a	77a	3.0a	49
Screen	6.0a	61b	3.7a	181	12.0a	1b	1.0c	140a	6.0a	68a	3.0a	59
Concep II	6.0a	68ab	4.3a	178	6.0c	61ab	4.0a	95b	6.0a	72a	2.7a	61
Concep II/Apron	6.0a	71ab	4.2a	161	8.0b	40ab	3.0b	62b	6.0a	72a	2.7a	60
Dual												
Unsafened	4.0b	64a	4.0a	155	14.0a	0a	0.0c	0b	13.0a	0b	0.0b	0
Screen	6.0a	63a	4.0a	135	10.0b	5a	2.0a	35a	10.0b	44a	2.0a	24
Concep II	7.0a	52a	4.3a	133	14.0a	1a	1.0b	10a	12.0ab	31a	1.7a	11
Concep II/Apron	7.0a	68a	3.7a	115	11.0b	16a	1.7ab	18a	7.0c	41a	2.3a	22
Lasso												
Unsafened	7.0a	64a	3.8a	96	13.0a	1a	1.0a	10ab	14.0a	0b	0.0b	0
Screen	7.0a	52a	4.0a	130	14.0a	0a	0.0b	0b	9.0b	41a	2.0a	26
Concep II	7.0a	59a	4.3a	122	14.0a	0a	0.0b	0b	9.0b	36a	2.3a	30
Concep II/Apron	7.0a	67a	3.5a	124	13.0a	7a	1.3a	49a	9.0b	32a	2.0a	28

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 9. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Golden Harvest H501 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	89a	4.0a	154	6.0a	87a	4.0a	124ab	4.0a	53b	3.3a	89
Screen	6.0a	89a	4.0a	164	6.0a	81a	3.7a	96bc	4.0a	92a	3.0a	59
Concep II	6.0a	87a	4.2a	173	7.0a	75a	3.3a	82bc	4.0a	85a	3.3a	66
Concep II/Apron	5.0a	95a	4.2a	189	6.0a	87a	4.0a	131a	4.0a	89a	3.3a	69
Dual												
Unsafened	12.0a	19b	2.7b	42	14.0a	0c	0.0c	0b	12.0a	0b	0.0c	0
Screen	6.0b	89a	4.0a	97	8.0c	84a	3.0a	52a	9.0b	69a	2.3a	31
Concep II	7.0b	85a	4.2a	107	10.0b	37b	1.7b	18b	10.0ab	43a	2.0a	18
Concep II/Apron	7.0b	75a	3.8a	104	9.0bc	24b	3.0a	28ab	12.0a	13b	1.3b	23
Lasso												
Unsafened	9.0a	3b	1.3b	60	14.0a	0c	0.0b	0b	13.0a	27b	0.0b	1
Screen	7.0b	83a	3.7a	96	8.0c	76a	3.0a	37a	11.0ab	71a	2.0a	15
Concep II	7.0b	92a	3.8a	68	9.0bc	65a	3.0a	31a	10.0b	68a	1.7a	15
Concep II/Apron	7.0b	88a	3.7a	98	10.0b	39b	2.7a	30a	10.0b	51a	1.7a	15

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 10. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Golden Harvest H505 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	95a	4.7a	190	6.0b	81a	4.0a	103a	4.0a	71b	2.7a	100
Screen	6.0a	89a	4.2a	165	7.0ab	55b	3.7a	90a	4.0a	71b	3.0a	94
Concep II	5.0a	89a	3.8a	153	6.0b	65ab	4.0a	108a	4.0a	95a	3.0a	46
Concep II/Apron	6.0a	95a	4.0a	173	8.0a	48b	3.3a	79a	4.0a	93ab	3.3a	69
Dual												
Unsafened	14.0a	3b	0.7b	95	14.0a	0b	0.0c	0b	11.0a	27ab	2.0a	5
Screen	6.0b	85a	4.7a	119	8.0b	41a	3.0a	44a	9.0a	45a	2.0a	30
Concep II	6.0b	83a	4.5a	122	8.0b	31a	2.7a	33a	9.0a	29ab	2.0a	11
Concep II/Apron	7.0b	83a	4.0a	111	13.0a	9b	1.0b	47a	10.0a	16b	0.7b	3
Lasso												
Unsafened	13.0a	4b	2.0b	70	14.0a	0b	0.0c	0b	13.0a	0c	0.0b	0
Screen	6.0b	89a	3.3a	109	9.0c	39a	2.7a	28a	8.0b	64a	2.7a	30
Concep II	6.0b	91a	4.0a	82	11.0b	5b	1.7b	28a	11.0a	28b	2.0a	33
Concep II/Apron	6.0b	96a	3.8a	109	11.0b	13b	1.0b	14a	11.0a	27b	2.3a	17

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 11. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Golden Harvest H510 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0 a <sup>c</sup>	93 a	3.7a	165	6.0b	65a	4.0a	120a	4.0a	89a	3.3a	77
Screen	6.0a	1a	4.3a	138	9.0a	31b	3.3a	79b	5.0a	97a	3.7a	73
Concep II	5.0a	95a	4.5a	188	7.0b	48ab	3.7a	120a	5.0a	88a	3.3a	81
Concep II/Apron	6.0a	92a	4.0a	169	6.0b	36b	3.7a	132.a	4.0a	84a	3.3a	80
Dual												
Unsafened	12.0a	7c	2.7b	38	14.0a	0c	0.0c	0b	13.0a	0c	0.0c	0
Screen	6.0c	93a	4.0a	105	9.0b	29a	3.0a	51a	6.0c	85a	3.0a	34
Concep II	8.0b	63b	4.0a	100	10.0b	19ab	2.7a	23ab	10.0b	31b	2.3a	27
Concep II/Apron	7.0bc	71b	3.7ab	99	10.0b	11b	1.7b	14b	11.0ab	25b	1.0b	10
Lasso												
Unsafened	12.0a	4b	1.3b	70	14.0a	0b	0.0c	0a	13.0a	0c	0.0b	0
Screen	7.0b	87a	3.7a	88	9.0c	21a	2.7a	27a	7.0c	6a	3.0a	31
Concep II	7.0b	85a	3.7a	79	12.0b	5a	1.7b	20a	9.0bc	41b	2.7a	26
Concep II/Apron	7.0b	71a	3.7a	72	10.0c	16a	2.7a	29a	10.0b	41b	2.3a	19

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 12. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Northrup King 9740Y grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	91a	3.7a	197	6.0b	76a	4.0a	110a	7.0a	68a	3.0a	61
Screen	6.0a	89a	4.2a	158	7.0ab	72ab	4.0a	88ab	5.0a	69a	3.0a	64
Concep II	6.0a	89a	3.7a	155	8.0a	51b	3.3a	75b	5.0a	81a	3.0a	65
Concep II/Apron	6.0a	93a	4.0a	140	7.0ab	76a	4.0a	71b	5.0a	80a	3.3a	71
Dual												
Unsafened	6.0a	87a	3.8a	91	14.0a	0c	0.0b	0b	11.0a	9c	0.7c	67
Screen	6.0a	91a	3.8a	116	8.0b	67a	3.0a	27ab	6.0c	73a	3.0a	23
Concep II	6.0a	97a	4.3a	158	9.0b	41b	3.0a	42a	9.0ab	44b	2.3ab	53
Concep II/Apron	6.0a	95a	3.8a	116	8.0b	31b	3.0a	27ab	8.0bc	32b	2.0b	13
Lasso												
Unsafened	7.0a	80a	3.7a	91	14.0a	0c	0.0b	0b	11.0a	24c	1.7a	10
Screen	6.0a	89a	4.0a	99	9.0c	53a	2.7a	36a	8.0b	52ab	2.3a	28
Concep II	7.0a	87a	4.0a	123	10.0c	47a	2.7a	31a	9.0ab	63a	2.3a	22
Concep II/Apron	6.0a	89a	3.8a	118	12.0b	23b	3.0a	10ab	10.0ab	37bc	2.0a	15

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.



**Table 13. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to NC<sup>+</sup> 172 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safeners	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	85a	4.7a	189	6.0a	77a	3.7a	134a	4.0a	93a	3.0a	65
Screen	6.0a	87a	4.3a	138	6.0a	76a	3.7a	110ab	4.0a	89a	3.0a	58
Concep II	5.0a	85a	4.3a	168	6.0a	81a	3.3a	101b	4.0a	89a	3.3a	57
Concep II/Apron	6.0a	84a	4.3a	182	6.0a	88a	3.7a	97b	4.0a	95a	3.0a	5.0
Dual												
Unsafened	7.0a	76a	4.0a	121	14.0a	0d	0.0b	0b	11.0a	5c	0.7c	18
Screen	6.0a	91a	3.6a	104	8.0c	81a	3.0a	48a	6.0c	75a	2.7a	35
Concep II	7.0a	79a	3.7a	95	9.0c	32b	3.0a	37a	9.0ab	41b	2.0a	28
Concep II/Apron	6.0a	87a	4.3a	139	11.0b	7c	2.3a	33a	7.0bc	32b	1.0b	33
Lasso												
Unsafened	6.0a	95a	4.7a	93	14.0a	0c	0.0b	0a	13.0a	0c	0.0c	0
Screen	6.0a	89ab	4.0a	119	9.0c	57a	3.0a	28a	9.0b	72a	2.7a	27
Concep II	6.0a	88ab	4.8a	111	10.0bc	41a	2.7a	25a	11.0ab	39b	2.3ab	18
Concep II/Apron	6.0a	80b	3.9a	107	11.0b	15b	2.0a	20a	11.0ab	39b	1.7b	25

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 14. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to NC<sup>+</sup> 174 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	88ab	4.3a	186	7.0a	88a	3.7a	88a	5.0a	88a	3.0a	59
Screen	5.0a	95ab	3.8a	151	7.0a	80a	3.7a	85a	5.0a	92a	3.3a	58
Concep II	6.0a	97a	4.3a	179	6.0a	83a	3.7a	92a	5.0a	93a	3.0a	60
Concep II/Apron	6.0a	83b	3.8a	150	7.0a	84a	3.3a	114a	5.0a	91a	3.0a	56
Dual												
Unsafened	7.0a	63b	3.9a	97	14.0a	0c	0.0b	0b	9.0a	5c	1.3b	17
Screen	6.0a	88a	3.8a	99	8.0b	69a	3.3a	39a	6.0b	88a	2.7a	36
Concep II	7.0a	89a	3.6a	100	9.0b	40b	2.7a	26ab	8.0ab	60b	2.3ab	22
Concep II/Apron	7.0a	87a	3.8a	115	9.0b	35b	2.7a	33a	10.0a	41b	2.0ab	24
Lasso												
Unsafened	8.0a	60b	3.9a	90	14.0a	0c	0.0b	0b	11.0a	5c	1.0b	2
Screen	6.0b	91a	3.5a	61	8.0b	47a	3.0a	21ab	9.0ab	73a	2.7a	28
Concep II	6.0b	80a	3.9a	102	9.0b	43ab	2.7a	33a	7.0b	47ab	2.0a	26
Concep II/Apron	7.0ab	80a	3.9a	90	9.0b	28b	3.0a	28ab	8.0ab	43b	2.0a	145

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 15. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to NC<sup>2</sup> 271 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	95a	4.0a	160	6.0c	88a	3.7a	95a	5.0a	89a	3.0a	76
Screen	6.0a	84a	4.2a	147	7.0b <sup>c</sup>	84a	4.0a	118a	6.0a	76ab	3.0a	69
Concep II	6.0a	93a	4.7a	181	8.0b	59b	2.7b	41b	6.0a	65b	3.0a	68
Concep II/Apron	6.0a	92a	3.8a	167	10.0a	29c	2.3b	21b	6.0a	72ab	2.7a	68
Dual												
Unsafened	8.0a	48c	3.8a	72	14.0a	0b	0.0c	0c	11.0a	4c	1.3b	23
Screen	6.0b	91a	4.3a	107	8.0b	69a	2.7b	41b	6.0b	72a	2.7a	35
Concep II	6.0b	97b	3.9a	119	7.0b	81a	4.0a	112a	12.0a	33b	2.7a	24
Concep II/Apron	7.0ab	83a	4.0a	148	8.0b	88a	3.3ab	90a	8.0b	33b	2.3a	25
Lasso												
Unsafened	9.0a	40b	3.3a	63	14.0a	0c	0.0b	0b	12.0a	0c	0.0b	0
Screen	6.0b	89a	3.8a	114	8.0c	77a	3.0a	44a	8.0b	76a	2.7a	37
Concep II	6.0b	95a	4.2a	73	8.0c	60a	3.0a	35a	9.0b	47b	2.7a	30
Concep II/Apron	7.0b	92a	3.7a	79	10.0b	37b	2.3a	19ab	8.0b	47b	2.7a	31

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 16. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Northrup King 2656 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	93ab	3.7a	159	6.0b	83a	3.7a	113ab	4.0a	84a	3.3a	93
Screen	5.0a	88ab	3.8a	137	7.0ab	76a	3.7a	121a	4.0a	72a	3.3a	84
Concep II	5.0a	95a	4.0a	153	8.0a	75a	3.3a	94b	4.0a	83a	3.0a	78
Concep II/Apron	5.0a	80b	3.7a	195	6.0b	84a	4.0a	138a	4.0a	81a	3.3a	77
Dual												
Unsafened	14.0a	1b	1.3b	60	14.0a	0c	0.0c	0b	12.0a	0c	0.0c	0
Screen	7.0b	85a	3.7a	80	8.0b	69a	2.7a	41a	8.0b	53a	2.3a	24
Concep II	7.0b	75a	3.7a	89	9.0b	49a	2.7a	24ab	9.0b	31ab	2.0ab	13
Concep II/Apron	6.0b	84a	4.0a	109	9.0b	13b	1.7b	48a	11.0ab	9bc	1.3b	10
Lasso												
Unsafened	14.0a	0c	0.0b	0	14.0a	0b	0.0b	0b	12.0a	0b	0.0b	0
Screen	7.0b	83a	3.7a	100	9.0c	44a	3.0a	32a	9.0b	52a	2.3a	21
Concep II	7.0b	56b	3.5a	219	11.0b	44a	2.7a	20ab	9.0b	49a	2.3a	26
Concep II/Apron	8.0b	81a	3.7a	92	12.0b	31a	2.3a	15ab	9.0b	39a	2.0a	18

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 17. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Northrup King 2778 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0a <sup>c</sup>	88b	4.3a	171	6.0b	64a	4.0a	122a	5.0a	73a	3.3a	93
Screen	6.0a	83a	4.2a	171	8.0a	44a	3.7a	96ab	6.0a	41b	3.0a	71
Concep II	6.0a	84b	4.3a	180	7.0ab	47a	3.7a	90b	5.0a	52ab	3.3a	74
Concep II/Apron	6.0a	80b	4.3a	238	8.0a	51a	3.3a	76b	6.0a	44b	3.0a	59
Dual												
Unsafened	9.0a	7b	3.7a	253	14.0a	0c	0.0c	0b	12.0a	0c	0.0c	0
Screen	6.0b	71a	3.5a	116	8.0c	45a	3.0a	33a	9.0b	45a	2.3a	26
Concep II	7.0b	63a	3.7a	129	10.0b	21b	2.7ab	21a	11.0ab	23b	1.3b	37
Concep II/Apron	7.0b	71a	4.2a	112	10.0b	15b	2.0b	21a	11.0ab	40ab	1.3b	17
Lasso												
Unsafened	13.0a	4b	1.3b	200	14.0a	0c	0.0d	0b	14.0a	0b	0.0c	0
Screen	6.0b	73a	3.7a	99	9.0c	32a	3.0a	47a	11.0b	36a	2.3a	28
Concep II	7.0b	63a	3.8a	121	11.0b	15ab	2.0b	50a	9.0b	31ab	2.0a	29
Concep II/Apron	6.0b	76a	4.3a	93	12.0b	4bc	1.0c	10a	12.0ab	8b	1.0b	25

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 18. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Pioneer 8358 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	6.0 <sup>c</sup> a	87a	4.3a	147	9.0a	59b	2.7b	25b	4.0c	89a	3.3a	56
Screen	6.0a	83a	4.4a	170	8.0ab	92a	3.7a	101a	7.0b	84a	2.7ab	48
Concep II	6.0a	88a	4.0a	149	7.0b	93a	3.7a	89a	6.0bc	85a	3.3a	65
Concep II/Apron	6.0a	83a	4.7a	154	8.0ab	81a	3.3ab	97a	12.0a	52a	2.0b	15
Dual												
Unsafened	14.0a	0b	0.0b	0	8.0a	71b	2.7b	54b	7.0a	76a	2.7a	32
Screen	6.0b	83a	4.1a	111	7.0ab	84ab	3.0ab	61b	7.0a	83a	3.0a	44
Concep II	6.0b	83a	4.2a	105	7.0ab	84ab	3.3ab	49b	8.0a	81a	2.6a	32
Concep II/Apron	7.0b	79a	4.3a	116	6.0b	88a	3.7a	115a	8.0a	77a	2.7a	36
Lasso												
Unsafened	14.0a	0b	0.0b	0	8.0a	81a	3.3a	44a	9.0a	65a	2.7a	26
Screen	7.0b	91a	3.7a	73	8.0a	81a	3.0a	44a	8.0a	80a	2.7a	33
Concep II	6.0b	80a	4.0a	96	9.0a	71ab	3.0a	35a	9.0a	77a	2.6a	27
Concep II/Apron	7.0b	81a	4.1a	61	9.0a	56b	2.7a	35a	8.0a	88a	2.7a	28

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Of seedlings surviving at 21 days after planting.

<sup>c</sup> Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 19. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Pioneer 8493 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0a <sup>c</sup>	91a	4.7a	195	7.0a	68a	3.7a	107a	5.0a	81a	3.3a	74
Screen	5.0a	89a	4.3a	181	7.0a	49a	3.3a	67b	5.0a	69a	3.3a	78
Concep II	6.0a	95a	4.0a	173	7.0a	51a	3.3a	111a	5.0a	69a	3.0a	64
Concep II/Apron	5.0a	95a	4.3a	188	7.0a	59a	3.7a	113a	7.0a	57a	3.0a	63
Dual												
Unsafened	14.0a	1b	0.7b	20	8.0b	60a	3.0a	42a	12.0a	52a	2.0b	15
Screen	6.0b	95a	4.0a	109	7.0b	53ab	3.0a	66a	9.0b	65a	3.0a	41
Concep II	6.0b	89a	4.3a	127	8.0b	53ab	3.0a	53a	9.0b	61a	3.0a	45
Concep II/Apron	6.0b	92a	3.7a	130	10.0a	35b	3.0a	49a	8.0b	41a	2.3ab	35
Lasso												
Unsafened	14.0a	0b	0.0b	0	10.0a	60a	2.3b	34b	10.0a	43a	1.7b	30
Screen	7.0b	88a	4.3a	115	8.0b	51a	3.3a	74a	10.0a	60a	2.7a	44
Concep II	6.0b	93a	4.2a	119	9.0ab	49a	3.3a	50ab	10.0a	60a	2.7a	30
Concep II/Apron	6.0b	87a	3.7a	111	9.0ab	51a	3.0ab	50ab	10.0a	57a	2.3ab	24

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 20. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Pioneer 8686 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in a greenhouse at Manhattan, KS.**

Herbicide Safener	1987				1988				1989			
	Emerg.	Emerg.	Leaf Stage <sup>b</sup>	Weight/Plant <sup>b</sup>	Emerg.	Emerg.	Leaf Stage	Weight/Plant	Emerg.	Emerg.	Leaf Stage	Weight/Plant
	(days)	(%)		(mg)	(days)	(%)		(mg)	(days)	(%)		(mg)
No Herbicide												
Unsafened	5.0 <sup>c</sup> a	95a	4.0a	155	7.0a	87a	4.0a	128a	5.0a	88a	3.3a	65
Screen	6.0a	91a	4.0a	186	7.0a	87a	3.3a	85b	5.0a	85a	3.0a	63
Concep II	5.0a	93a	3.8a	158	6.0a	77a	3.3a	114ab	4.0a	85a	3.0a	67
Concep II/Apron	5.0a	93a	3.7a	168	6.0a	83a	4.0a	112ab	4.0a	83a	3.3a	68
Dual												
Unsafened	14.0a	0b	0.0b	0	14.0a	0c	0.0b	0b	12.0a	1c	0.7b	0
Screen	6.0b	89a	3.7a	102	7.0c	55a	2.7a	35a	5.0c	81a	3.0a	34
Concep II	6.0b	97a	4.0a	109	9.0b	24b	3.0a	29ab	8.0b	53ab	2.3a	33
Concep II/Apron	6.0b	85a	4.2a	106	8.0bc	61a	3.0a	36a	10.0ab	41b	2.3a	25
Lasso												
Unsafened	9.0a	0b	0.0b	0	14.0a	0a	0.0c	0b	14.0a	0c	0.0b	0
Screen	6.0b	88a	4.2a	123	11.0b	28a	2.0b	23ab	8.0b	83a	2.7a	31
Concep II	7.0b	75a	3.7a	91	8.0c	28a	3.0a	41a	9.0b	56c	2.3a	19
Concep II/Apron	7.0b	84a	3.8a	85	10.0b	33a	3.0a	20ab	9.0b	63ab	2.3a	20

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Of seedlings surviving at 21 days after planting.

<sup>c</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 21. Effect of Lasso and Dual applied preplant incorporated 5.0 and 4.0 lbs ai/acre, respectively, on dry weight of grain sorghum planted with and without seed safeners<sup>a</sup> in a glass house in 1987 at Manhattan, KS.**

Herbicide	Safener	Plant dry Weight <sup>ab</sup>
		(mg)
None	Unsafened	68a
	Screen	62a
	Concep II	61a
	Concep II/Apron	65a
Dual	Unsafened	7c
	Screen	31a
	Concep II	29ab
	Concep II/Apron	22b
Lasso	Unsafened	4b
	Screen	29a
	Concep II	26a
	Concep II/Apron	27a

<sup>a</sup> Of seedlings surviving at 21 days after planting, averaged across hybrids.

<sup>b</sup> Means within an herbicide followed by different letters are significantly different at the P>0.05 level of Fisher's LSD.

**Table 22. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Asgrow Chapparral grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	12.3a	12.0a	61.3	6.0a	10.6b	11.1b	65.0a	6.0a	11.9a
Screen	5.0a	11.7a	11.8a	61.0	5.0a	13.9a	13.3a	61.7b	6.0a	9.8b
Concep II	5.0a	12.5a	12.6a	61.0	5.0a	13.5a	12.6a	62.3ab	6.0a	13.1a
Concep II/Apron	5.0a	13.7a	13.3a	61.0	5.0a	13.2a	12.6a	61.7b	6.0a	12.1a
Dual										
Unsafened	5.0a	3.4b	4.9b	67.3	8.0a	4.3b	6.1b	66.7a	8.0a	4.5c
Screen	5.0a	12.5a	12.3a	64.7	5.0b	13.7a	12.3a	64.0b	6.0b	9.5b
Concep II	5.0a	12.1a	12.8a	63.3	5.0b	13.4a	12.5a	65.3ab	6.0b	11.6a
Concep II/Apron	5.0a	13.1a	12.4a	63.3	5.0b	12.9a	12.0a	63.7ab	6.0b	11.1ab
Lasso										
Unsafened	7.0a	0.8b	2.3b	68.7	8.0a	3.5b	5.3b	66.7a	8.0a	9.7a
Screen	5.0b	12.3a	12.3a	65.0	6.0b	12.5a	11.7a	65.3a	6.0b	3.7b
Concep II	5.0b	12.6a	13.1a	62.3	5.0b	12.9a	12.8a	65.7a	6.0b	10.3a
Concep II/Apron	5.0b	12.6a	12.8a	61.7	5.0b	12.6a	12.6a	63.3b	6.0b	10.1a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 23. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Asgrow GS75311 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Boom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	11.7a	12.0a	64.0	7.0a	10.2a	9.9b	67.7a	6.0a	11.3ab
Screen	5.0a	11.3a	11.5a	61.3	6.0b	11.3a	11.7ab	64.0b	6.0a	10.5b
Concep II	5.0a	10.3a	11.7a	61.3	6.0b	12.0a	12.4a	64.0b	6.0a	9.3c
Concep II/Apron	5.0a	11.5a	11.9a	62.3	6.0b	11.1a	10.3b	67.0a	6.0a	12.3a
Dual										
Unsafened	6.0a	1.5b	3.1b	66.0	9.0a	1.2b	4.0b	70.7a	6.0a	10.7a
Screen	5.0b	12.1a	13.3a	62.7	6.0b	11.3a	11.3a	65.0c	6.0a	9.7a
Concep II	5.0b	11.7a	13.3a	61.0	6.0b	10.9a	11.5a	68.0b	6.0a	10.0a
Concep II/Apron	5.0b	13.1a	12.5a	61.7	6.0b	10.9a	10.1a	67.3b	6.0a	11.3a
Lasso										
Unsafened	6.0a	2.3b	4.5b	73.7	10.0a	2.2c	5.2c	69.7a	9.0a	5.8b
Screen	5.0b	12.7a	13.1a	62.7	6.0b	11.7a	12.0a	65.3b	6.0b	10.3a
Concep II	5.0b	11.5a	12.7a	62.3	6.0b	11.1ab	10.3ab	69.0a	6.0b	10.0a
Concep II/Apron	5.0b	11.9a	12.7a	62.3	6.0b	9.5b	9.8b	68.7a	6.0b	10.0a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 24. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Dekalb 18 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	12.0b	14.7a	51.7	6.0a	9.9a	11.0a	51.0a	6.0a	11.8ab
Screen	5.0a	14.3a	16.1a	51.7	6.0a	9.3a	10.1a	52.7a	6.0a	10.0b
Concep II	5.0a	12.9ab	15.3a	51.7	6.0a	9.4a	9.9a	51.0a	6.0a	10.9ab
Concep II/Apron	5.0a	12.4ab	14.7a	51.7	6.0a	9.7a	10.5a	51.0a	6.0a	11.9a
Dual										
Unsafened	7.0a	2.6b	5.5b	53.7	13.0a	1.3b	5.5c	52.7a	10.0a	4.0b
Screen	5.0b	12.9a	16.5a	51.3	6.0b	8.4a	11.2ab	52.0a	7.0b	10.5a
Concep II	5.0b	12.0a	15.9a	51.3	6.0b	7.9a	9.7b	51.0a	7.0b	10.6a
Concep II/Apron	5.0b	12.6a	16.2a	51.3	6.0b	9.2a	11.9a	51.0a	7.0b	11.0a
Lasso										
Unsafened	7.0a	1.5b	3.1c	55.0	11.0a	0.5b	3.1b	56.0a	11.0a	11.7a
Screen	5.0b	12.8a	14.7ab	53.3	6.0b	10.7a	11.8a	51.0b	7.0b	3.3b
Concep II	5.0b	11.1a	13.7b	53.3	6.0b	8.9a	10.5a	51.0b	6.0b	11.3a
Concep II/Apron	5.0b	11.1a	16.1a	53.3	6.0b	9.7a	11.7a	51.0b	6.0b	11.3a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 25. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Dekalb 40 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	14.3a	13.6a	60.7	6.0a	15.1a	15.1a	62.0b	6.0a	16.1a
Screen	5.0a	13.2a	13.3a	59.0	6.0a	12.7b	12.8b	64.7a	6.0a	16.2a
Concep II	5.0a	13.7a	13.5a	59.0	6.0a	13.4ab	13.6ab	62.0b	6.0a	15.7a
Concep II/Apron	5.0a	12.4a	12.6a	60.3	6.0a	14.0ab	14.3ab	62.0b	6.0a	16.3a
Dual										
Unsafened	5.0a	5.9c	8.0b	63.0	8.0a	4.2b	6.5b	66.0a	9.0a	5.1c
Screen	5.0a	12.0b	13.7a	61.3	6.0b	14.1a	14.3a	62.7b	6.0b	17.3a
Concep II	5.0a	14.6a	14.2a	61.0	5.0b	14.7a	14.5a	62.3b	6.0b	14.9b
Concep II/Apron	5.0a	11.6b	13.7a	61.0	6.0b	13.0a	13.5a	62.3b	6.0b	15.0b
Lasso										
Unsafened	5.0a	0.8b	1.8b	62.7	9.0a	0.7c	2.1b	67.3a	9.0a	4.0b
Screen	5.0a	13.2a	13.5a	61.0	6.0b	15.9a	14.7a	64.0b	6.0b	13.9a
Concep II	5.0a	13.4a	14.3a	61.0	6.0b	15.3ab	14.0a	63.3b	6.0b	13.6a
Concep II/Apron	5.0a	12.3a	14.1a	61.0	6.0b	13.7b	13.4a	66.0a	6.0b	14.3a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 26. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Dekalb 42Y grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	4.8c	7.7c	66.7	5.0a	14.8a	14.3a	61.0b	6.0a	9.5abc
Screen	5.0a	6.1c	9.9b	63.7	6.0a	11.7b	11.5b	65.0a	7.0a	8.7c
Concep II	5.0a	15.7a	15.6a	62.7	5.0a	11.8b	12.4b	61.0b	6.0a	10.9ab
Concep II/Apron	5.0a	9.7b	11.5b	62.0	5.0a	13.4ab	13.2ab	61.3b	6.0a	11.1a
Dual										
Unsafened	5.0a	1.1c	2.8c	66.7	10.0a	2.5c	5.9c	67.7a	14.0a	0.6c
Screen	5.0a	13.2a	14.0a	65.0	6.0b	12.3ab	12.5a	63.7b	7.0b	8.1b
Concep II	5.0a	8.3b	12.0ab	63.3	6.0b	12.6a	13.1a	62.7b	6.0b	11.1a
Concep II/Apron	5.0a	8.5b	11.7b	63.0	6.0b	10.4b	10.3b	67.3a	7.0b	10.5a
Lasso										
Unsafened	5.0a	0.4d	1.7b	67.0	9.0a	2.8b	4.2b	67.0a	12.0a	0.5c
Screen	5.0a	6.9c	12.6a	64.3	6.0b	12.4a	13.0a	63.7b	8.0b	7.3b
Concep II	5.0a	9.0b	12.7a	62.3	6.0b	11.9a	13.2a	64.3b	7.0bc	7.3b
Concep II/Apron	5.0a	11.5a	13.1a	65.3	6.0b	11.6a	12.4a	62.7b	6.0c	11.7a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 27. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Funk's G550 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	12.3a	13.1a	60.3	5.0a	11.8ab	13.6a	55.7b	6.0a	11.6a
Screen	5.0a	9.6b	10.7b	59.7	6.0a	9.8b	9.5b	58.3a	6.0a	10.9a
Concep II	5.0a	11.8a	12.3ab	60.0	5.0a	11.9a	12.6a	55.3b	6.0a	11.7a
Concep II/Apron	5.0a	10.9ab	11.8ab	60.3	5.0a	12.1a	12.7a	55.3b	6.0a	10.7a
Dual										
Unsafened	7.0a	11.2a	11.6ab	61.7	8.0a	4.4b	8.5a	63.0a	12.0a	1.4b
Screen	5.0b	8.9b	10.6b	61.7	6.0b	9.4a	10.2a	59.0c	6.0b	11.1a
Concep II	5.0b	12.1a	13.5a	61.7	8.0b	6.4a	8.9a	61.0b	6.0b	11.0a
Concep II/Apron	5.0b	10.6ab	11.4ab	61.7	6.0b	8.9a	10.0a	64.7a	6.0b	11.0a
Lasso										
Unsafened	7.0a	10.1a	11.6a	62.3	9.0a	2.1c	3.9c	68.0a	10.0a	3.1b
Screen	5.0b	10.7a	12.2a	62.3	7.0b	9.1a	10.1a	59.0bc	6.0b	9.5a
Concep II	5.0b	9.1a	11.8a	62.3	9.0a	4.3b	7.2b	60.7b	6.0b	9.5a
Concep II/Apron	5.0b	11.1a	11.9a	62.3	7.0b	9.3a	11.2a	58.0c	6.0b	10.5a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 28. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Funk's HW3177 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	13.1a	13.6a	51.3	5.0a	13.1a	13.9a	51.0a	6.0a	12.3ab
Screen	5.0a	12.9a	13.5a	51.3	5.0a	12.9a	13.9a	51.0a	6.0a	9.9c
Concep II	5.0a	13.5a	14.5a	51.3	5.0a	13.7a	13.1a	51.0a	6.0a	11.1bc
Concep II/Apron	5.0a	13.5a	14.0a	51.3	5.0a	14.2a	14.1a	51.0a	6.0a	12.9a
Dual										
Unsafened	6.0a	2.1b	2.7b	55.0	8.0a	5.1b	7.8b	52.7a	11.0a	1.7b
Screen	5.0b	13.8a	13.9a	54.7	5.0b	13.1a	12.5a	51.0a	6.0b	11.9a
Concep II	5.0b	13.7a	14.5a	52.7	5.0b	12.9a	13.6a	51.0a	6.0b	11.5a
Concep II/Apron	5.0b	13.8a	14.6a	53.0	5.0b	14.0a	13.7a	51.0a	6.0b	12.4a
Lasso										
Unsafened	7.0a	1.9b	3.5b	53.3	9.0a	1.4b	3.3b	53.3a	10.0a	2.3c
Screen	5.0b	13.5a	14.2a	52.0	5.0b	12.3a	13.7a	51.0b	6.0b	9.1b
Concep II	5.0b	13.1a	15.5a	52.0	5.0b	13.5a	14.3a	51.0b	6.0b	9.9b
Concep II/Apron	5.0b	14.0a	14.2a	52.0	5.0b	14.2a	14.7a	51.0b	6.0b	14.1a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.



**Table 29. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Funk's HW7217 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	13.5a	13.6a	60.7	5.0a	13.3a	13.1a	60.7b	6.0b	13.7a
Screen	5.0a	13.3a	13.6a	60.7	5.0a	12.5a	12.8a	61.3b	6.0b	14.2a
Concep II	5.0a	13.7a	14.0a	60.7	5.0a	13.1a	10.6b	64.3a	6.0b	14.3a
Concep II/Apron	5.0a	13.5a	13.7a	60.7	5.0a	13.3a	13.2a	60.3b	9.0a	14.5a
Dual										
Unsafened	5.0a	13.4a	13.3a	63.7	5.0a	12.9ab	12.8a	61.7b	8.0a	2.5b
Screen	5.0a	13.9a	13.6a	63.7	5.0a	14.2a	12.0a	63.3ab	6.0b	13.6a
Concep II	5.0a	14.1a	14.3a	63.7	6.0a	11.1b	9.9b	65.0a	9.0a	14.1a
Concep II/Apron	5.0a	13.9a	14.0a	63.7	5.0a	13.2a	11.9ab	61.3c	6.0b	13.3a
Lasso										
Unsafened	5.0a	13.1a	13.5a	61.7	6.0a	11.4c	11.1ab	62.7a	10.0a	2.4b
Screen	5.0a	13.7a	13.9a	61.0	5.0a	14.1a	12.0a	61.7b	6.0b	13.5a
Concep II	5.0a	13.9a	13.7a	61.0	5.0a	13.3ab	12.7a	61.7b	6.0b	13.9a
Concep II/Apron	5.0a	13.9a	14.1a	61.0	5.0a	12.1bc	10.0b	64.0a	6.0b	13.9a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 30. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Golden Harvest H501 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	13.1a	12.7a	60.3	7.0a	12.9a	13.2a	59.7a	6.0a	10.9a
Screen	5.0a	13.1a	13.1a	60.3	5.0b	13.3a	13.8a	58.7a	6.0a	10.1a
Concep II	5.0a	12.3a	12.7a	60.3	6.0ab	12.9a	13.7a	59.0a	6.0a	10.2a
Concep II/Apron	5.0a	12.7a	13.3a	60.3	6.0ab	13.3a	13.9a	59.7a	6.0a	10.8a
Dual										
Unsafened	6.0a	5.6b	8.1b	62.3	11.0a	0.5b	2.9b	67.3a	9.0a	4.4b
Screen	5.0b	12.7a	13.7a	60.3	5.0b	13.5ab	13.6a	58.7b	6.0b	10.3a
Concep II	6.0a	11.8a	13.1a	60.7	6.0b	11.9ab	12.5a	61.3b	6.0b	10.1a
Concep II/Apron	5.0b	13.1a	13.3a	60.7	5.0b	13.9a	13.5a	58.7b	6.0b	10.4a
Lasso										
Unsafened	7.0a	2.9b	6.1b	61.0	10.0a	0.7c	2.6c	69.3a	11.0a	1.5b
Screen	5.0b	13.2a	13.8a	60.7	5.0b	13.9a	14.1a	60.3b	6.0b	9.3a
Concep II	5.0b	12.2a	13.9a	61.0	5.0b	12.6ab	11.1b	60.7b	6.0b	9.3a
Concep II/Apron	5.0b	13.0a	13.0a	60.7	5.0b	11.8b	13.0ab	60.7b	6.0b	10.3a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 31. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Golden Harvest H505 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	12.2a	12.5a	62.3	9.0a	10.7b	11.5a	64.7b	6.0a	12.9a
Screen	5.0a	11.9a	12.3a	61.0	6.0b	12.5ab	12.1a	64.7b	6.0a	10.9b
Concep II	5.0a	12.7a	12.9a	62.0	6.0b	11.9ab	11.6a	67.7a	6.0a	12.8a
Concep II/Apron	5.0a	11.3a	11.9a	61.0	6.0b	13.7a	13.1a	63.7b	6.0a	13.3a
Dual										
Unsafened	8.0a	1.7b	3.9b	66.0	10.0a	1.1b	4.5c	71.0a	11.0a	3.3c
Screen	6.0b	12.7a	12.7a	63.7	6.0b	12.8a	13.5a	65.7c	6.0b	10.7b
Concep II	5.0b	11.9a	12.1a	63.7	6.0b	12.2a	13.1a	65.0c	6.0b	12.9a
Concep II/Apron	5.0b	12.8a	13.1a	64.0	6.0b	12.1a	11.2b	68.7b	6.0b	11.9ab
Lasso										
Unsafened	8.0a	1.4b	2.5b	66.0	11.0a	0.4c	2.0d	69.7a	8.0a	3.7c
Screen	5.0b	12.8a	13.5a	64.0	6.0b	13.1a	13.3a	65.7b	6.0b	7.9b
Concep II	5.0b	12.1a	14.1a	62.3	6.0b	10.9b	11.5b	68.7a	6.0b	11.3a
Concep II/Apron	5.0b	12.6a	12.9a	62.3	6.0b	11.7ab	9.7c	68.0a	6.0b	12.9a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 32. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Golden Harvest H510 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	12.3a	12.9a	61.0	7.0a	8.1b	10.3a	61.7a	6.0a	12.6a
Screen	5.0a	8.8b	12.1a	61.0	6.0ab	9.7ab	11.2a	61.3a	6.0a	13.3a
Concep II	5.0a	9.4b	11.9a	61.0	5.0b	9.1ab	9.6a	62.0a	6.0a	12.5a
Concep II/Apron	5.0a	10.1b	12.7a	61.0	5.0b	10.2a	11.0a	60.7a	6.0a	11.8a
Dual										
Unsafened	8.0a	3.6c	6.8b	63.0	11.0a	0.4b	1.6b	67.0a	13.0a	0.9b
Screen	5.0b	8.3b	12.6a	61.7	6.0b	9.6a	11.2a	62.0b	6.0b	11.9a
Concep II	5.0b	10.8a	13.7a	61.3	5.0b	9.9a	11.7a	61.0b	6.0b	12.4a
Concep II/Apron	5.0b	9.1ab	13.0a	61.7	6.0b	10.0a	11.81	61.0b	6.0b	2.4a
Lasso										
Unsafened	8.0a	1.9c	6.3b	61.3	10.0a	0.8b	1.4b	62.0b	10.0a	1.8c
Screen	5.0b	11.1a	11.9a	61.3	6.0b	9.6a	11.7a	62.0b	6.0b	11.9a
Concep II	5.0b	8.7b	12.2a	61.3	6.0b	8.1a	10.2a	62.3ab	6.0b	11.3a
Concep II/Apron	5.0b	8.8b	13.0a	63.3	6.0b	8.6a	10.5a	64.0a	6.0b	10.7a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 33. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 40 lbs ai/acre, respectively, to NC<sup>1</sup> 172 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	10.1b	11.8a	61.0	8.0a	5.9b	8.2b	62.0a	6.0a	13.7a
Screen	5.0a	10.0b	11.7a	61.0	5.0b	13.1a	13.0a	61.0a	6.0a	10.7b
Concep II	5.0a	11.4ab	12.2a	62.3	5.0b	13.3a	14.3a	59.7a	6.0a	11.8b
Concep II/Apron	5.0a	12.2a	12.7a	61.0	5.0b	13.5a	13.3a	62.0a	6.0a	13.8a
Dual										
Unsafened	5.0a	10.5a	12.3a	61.3	9.0a	2.1b	5.9c	65.0a	12.0a	1.7c
Screen	5.0a	8.9a	11.7a	61.3	5.0b	13.9a	14.3a	60.0b	6.0b	11.0b
Concep II	5.0a	10.1a	12.4a	61.3	5.0b	12.9a	12.5b	61.3b	6.0b	12.9a
Concep II/Apron	5.0a	10.0a	12.7a	61.3	5.0b	13.7a	14.0a	59.7b	6.0b	12.4ab
Lasso										
Unsafened	5.0a	9.4b	12.3a	61.0	11.0a	0.4b	1.3c	64.3a	11.0a	1.5b
Screen	5.0a	11.2a	12.3a	61.0	5.0b	13.3a	14.1a	60.7b	6.0b	10.4a
Concep II	5.0a	9.4a	11.6a	61.0	6.0b	11.7a	11.9b	62.0b	6.0b	11.2a
Concep II/Apron	5.0a	10.3a	12.5a	61.0	5.0b	11.5a	13.3ab	61.3b	6.0b	10.0a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 34. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to NC<sup>1</sup> 174 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	14.1a	14.1a	62.0	6.0a	11.3b	11.9c	63.0a	6.0a	12.2a
Screen	5.0a	14.1a	13.5a	63.7	5.0a	14.1a	14.3a	60.7b	6.0a	12.7a
Concep II	5.0a	13.6a	13.6a	64.0	5.0a	12.7ab	13.1abc	61.7b	6.0a	12.7a
Concep II/Apron	5.0a	12.8a	13.8a	64.0	5.0a	13.6a	14.1ab	60.7b	6.0a	13.1a
Dual										
Unsafened	5.0a	13.4a	13.7a	62.7	9.0a	3.0b	6.5b	65.7a	6.0a	11.7a
Screen	5.0a	13.2a	13.3a	62.7	5.0b	13.5a	13.1a	62.3b	6.0a	12.3a
Concep II	5.0a	14.1a	13.8a	62.3	6.0b	13.1a	13.1a	64.0ab	6.0a	11.2a
Concep II/Apron	5.0a	13.7a	13.7a	63.0	5.0b	13.3a	13.5a	63.3b	6.0a	12.5a
Lasso										
Unsafened	5.0a	12.7a	12.9a	64.0	9.0a	2.2b	4.8b	66.0a	6.0a	9.9b
Screen	5.0a	13.1a	14.9a	64.0	5.0b	13.5a	12.5a	63.3b	6.0a	12.9a
Concep II	5.0a	13.2a	14.3a	64.0	5.0b	12.3a	13.5a	63.3b	6.0a	11.4ab
Concep II/Apron	5.0a	12.4a	13.3a	63.7	5.0b	12.8a	13.2a	63.3b	6.0a	12.9a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 35. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to NC 271 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	11.9a	11.9ab	61.3	5.0a	13.8a	13.7a	62.3b	6.0a	11.5a
Screen	5.0a	7.1b	9.1c	61.0	5.0a	13.1a	13.3a	62.7b	6.0a	10.2a
Concep II	5.0a	8.9b	10.7bc	61.0	5.0a	12.6a	11.0b	67.7a	6.0a	11.8a
Concep II/Apron	5.0a	13.5a	13.7a	61.0	5.0a	13.8a	13.8a	62.7b	6.0a	11.4a
Dual										
Unsafened	5.0a	10.9a	12.3a	62.3	6.0a	7.8b	9.5b	66.0ab	10.0a	4.7b
Screen	5.0a	10.5a	11.3a	63.0	5.0a	13.1a	13.5a	63.0c	6.0b	10.4a
Concep II	5.0a	8.4b	12.1a	63.0	5.0a	12.9a	11.5ab	67.3a	6.0b	11.1a
Concep II/Apron	5.0a	10.7a	11.5a	63.3	5.0a	13.1a	12.9a	64.3bc	6.0b	11.7a
Lasso										
Unsafened	7.0a	8.6b	10.7a	62.7	9.0a	2.1b	3.7c	68.3a	6.0a	8.6c
Screen	5.0b	11.5a	12.1a	63.0	6.0b	12.5a	10.5b	68.0a	6.0a	12.1a
Concep II	5.0b	10.5ab	11.8a	62.7	5.0b	12.9a	12.6a	63.0b	6.0a	5.2d
Concep II/Apron	5.0b	11.1a	11.9a	63.0	5.0b	13.1a	12.7a	63.0b	6.0a	10.4ab

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 36. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Northrup King 2656 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	9.2b	10.3b	63.7	7.0a	9.5b	9.0b	58.7a	6.0a	11.6a
Screen	5.0a	12.0a	12.9a	60.3	5.0b	13.3a	13.4a	56.7b	6.0a	7.8b
Concep II	5.0a	12.9a	12.9a	60.3	5.0b	12.9a	13.0a	56.7b	6.0a	11.4a
Concep II/Apron	5.0a	12.4a	12.9a	60.3	5.0b	13.5a	12.9a	57.0ab	6.0a	11.8a
Dual										
Unsafened	7.0a	5.5c	7.4b	65.0	8.0a	0.5b	1.4b	63.0b	8.0a	3.2b
Screen	6.0b	8.0b	8.6b	65.0	6.0b	12.9a	13.4a	56.7a	6.0b	9.4a
Concep II	5.0c	12.5a	12.9a	61.0	5.0b	12.3a	12.3a	57.7a	6.0b	10.5a
Concep II/Apron	5.0c	12.4a	12.3a	61.0	5.0b	12.0a	13.3a	57.3a	6.0b	10.9a
Lasso										
Unsafened	7.0a	0.6b	2.8b	69.0	12.0a	0.7c	0.2c	63.0b	11.0a	1.1b
Screen	5.0b	12.3a	13.1a	60.0	5.0b	12.4a	13.3a	57.0a	6.0b	8.6a
Concep II	5.0b	11.9a	12.1a	60.0	6.0b	10.5ab	10.0b	57.0a	6.0b	9.9a
Concep II/Apron	5.0b	12.7a	13.5a	60.0	5.0b	10.1b	10.9b	58.7a	6.0b	9.1a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 37. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Northrup King 9740Y grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	11.7b	12.6ab	62.3a	5.0a	11.7ab	12.6a	62.3	6.0a	11.7ab
Screen	5.0a	13.6a	13.9a	62.7a	5.0a	13.6a	13.9a	62.7	6.0a	7.9c
Concep II	5.0a	10.6b	11.8b	62.0a	5.0a	10.6b	11.8a	62.0	6.0a	10.1b
Concep II/Apron	5.0a	10.6b	11.8b	62.3a	5.0a	10.6b	11.8a	62.3	6.0a	12.2a
Dual										
Unsafened	5.0a	11.7b	12.3a	63.0a	9.0a	2.8b	5.6c	67.3	7.0a	10.4a
Screen	5.0a	13.7a	13.3a	63.0a	6.0b	10.5a	10.3b	66.3	6.0a	7.8b
Concep II	5.0a	10.9b	11.7a	62.7a	6.0b	11.9a	11.5ab	64.0	6.0a	10.0a
Concep II/Apron	5.0a	11.5b	12.5a	63.0a	6.0b	12.3a	12.5a	63.7	6.0a	10.1a
Lasso										
Unsafened	5.0a	12.4a	12.5a	63.3a	0.0a	0.7b	2.7c	68.3	7.0a	10.4a
Screen	5.0a	8.9b	11.3a	63.7a	6.0b	12.0a	12.4a	64.7	6.0a	7.8b
Concep II	5.0a	10.0b	11.8a	63.7a	6.0b	11.0a	9.5b	69.0	6.0a	10.0a
Concep II/Apron	5.0a	9.8b	12.0a	63.7a	6.0b	11.2a	11.6a	62.7	6.0a	10.1a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 38. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Pioneer 8358 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0ab	12.3a	12.2a	61.3	5.0a	15.1a	13.2a	64.31	6.0a	15.2a
Screen	5.0a	13.8a	13.9a	61.3	5.0a	14.1a	12.5a	70.0a	6.0a	13.3b
Concep II	5.0a	14.2a	13.8a	61.3	5.0a	14.2a	13.2a	65.0b	6.0a	14.3ab
Concep II/Apron	5.0a	13.5a	13.5a	61.3	5.0a	14.3a	13.7a	64.7b	6.0a	14.1ab
Dual										
Unsafened	7.0a	3.6b	5.6b	70.0	5.0a	15.1a	12.9a	65.7b	6.0a	13.7a
Screen	5.0b	13.9a	13.9a	62.0	5.0a	13.9a	10.9a	69.0a	6.0a	12.9a
Concep II	5.0b	14.6a	14.7a	61.7	5.0a	14.1a	12.3a	67.3ab	6.0a	13.4a
Concep II/Apron	5.0b	14.2a	14.1a	62.0	5.0a	14.9a	12.7a	65.7b	6.0a	13.7a
Lasso										
Unsafened	7.0a	6.4b	8.5b	64.3	5.0a	12.9b	11.1b	70.3a	6.0a	13.3a
Screen	5.0b	14.0a	13.9a	63.0	5.0a	15.1a	13.8a	66.0b	6.0a	12.5a
Concep II	5.0b	13.2a	12.6a	62.7	5.0a	14.1ab	12.5ab	65.7b	6.0a	13.8a
Concep II/Apron	5.0b	13.3a	14.1a	62.7	5.0a	13.9ab	11.3b	67.0ab	6.0a	13.6a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 39. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Pioneer 8493 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	9.9b	9.7b	60.0	5.0a	12.2a	11.7a	60.0b	6.0a	12.0ab
Screen	5.0a	13.0a	13.1a	60.0	5.0a	11.9a	12.2a	60.0b	6.0a	10.5b
Concep II	5.0a	12.5a	12.6a	59.7	5.0a	11.5a	10.4a	62.3a	6.0a	12.2ab
Concep II/Apron	5.0a	13.1a	13.5a	60.3	5.0a	11.1a	11.1a	60.0b	6.0a	13.1a
Dual										
Unsafened	8.0a	1.1b	2.3b	74.7	5.0a	12.7a	11.2a	60.0b	6.0a	10.9ab
Screen	5.0b	12.5a	12.3a	61.0	5.0a	11.3a	11.0a	62.7a	6.0a	11.4b
Concep II	5.0b	12.7a	13.3a	61.0	5.0a	11.4a	11.2a	61.0b	6.0a	10.9ab
Concep II/Apron	5.0b	11.2a	11.9a	61.0	5.0a	11.4a	11.7a	60.0b	6.0a	13.3a
Lasso										
Unsafened	7.0a	1.0b	2.4b	74.0	5.0a	11.1a	11.1a	61.0b	6.0a	11.3a
Screen	5.0b	12.5a	12.7a	61.3	5.0a	11.9a	11.7a	60.7b	6.0a	10.9a
Concep II	5.0b	12.5a	12.5a	60.7	5.0a	10.7a	10.6a	64.7a	6.0a	10.5a
Concep II/Apron	5.0b	12.5a	13.9a	60.3	5.0a	11.1a	11.1a	61.0b	6.0a	12.2a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 40. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 4.0 lbs ai/acre, respectively, to Pioneer 8686 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a <sup>b</sup>	12.7ab	13.3a	55.7	6.0a	11.5a	12.9a	56.0a	6.0a	2.4a
Screen	5.0a	10.8b	12.3a	55.7	5.0a	13.4a	13.2a	56.0a	6.0a	11.3a
Concep II	5.0a	14.0a	14.5a	55.7	5.0a	13.4a	13.3a	56.0a	6.0a	11.7a
Concep II/Apron	5.0a	12.0b	13.3a	55.7	5.0a	12.9a	12.3a	57.3a	6.0a	11.9a
Dual										
Unsafened	7.0a	3.8b	8.7b	56.7	8.0a	1.3b	2.6b	66.0a	10.0a	2.5c
Screen	5.0b	10.7a	13.1a	55.0	5.0b	13.5a	14.0a	56.0b	6.0b	10.9b
Concep II	5.0b	13.6a	14.3a	55.0	5.0b	13.1a	13.9a	56.0b	6.0b	12.5ab
Concep II/Apron	5.0b	12.5a	13.5a	55.0	5.0b	13.7a	14.3a	56.0b	6.0b	12.9a
Lasso										
Unsafened	8.0a	1.7c	4.7c	59.7	10.0a	2.2b	5.2b	60.0a	11.0a	2.4b
Screen	5.0b	14.2a	15.3a	60.0	5.0b	12.7a	13.0a	56.3b	6.0b	11.3a
Concep II	5.0b	11.6b	13.4a	58.7	5.0b	12.5a	12.9a	56.7b	6.0b	11.7a
Concep II/Apron	5.0b	12.7ab	15.8a	58.3	5.0b	13.3a	14.3a	56.3b	6.0b	11.9a

<sup>a</sup> Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup> Means of each column followed by a common letter within each herbicide and year are not significantly different at the P<0.05 LSD.

**Table 41. Effects of Lasso and Dual applied preplant incorporated at 5.0 and 40 lbs ai/acre, respectively, to Northrup King 2778 grain sorghum planted with and without seed safeners<sup>a</sup> in 1987, 1988, and 1989 in the field at Manhattan, KS.**

Herbicide Safener	1987				1988				1989	
	Emerg.	Plants	Heads	Bloom	Emerg.	Plants	Heads	Bloom	Emerg.	Plants
	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)	(1000/ac)	(days)	(days)	(1000/ac)
No Herbicide										
Unsafened	5.0a	12.3ab	12.9ab	61.0	6.0a	13.1a	13.7a	62.0c	6.0a	8.8b
Screen	5.0a	10.5b	11.3b	61.0	6.0a	12.9a	12.5ab	64.0b	7.0a	6.3c
Concep II	5.0a	12.2ab	13.7a	61.0	6.0a	11.6a	10.3bc	66.0a	6.0a	10.7a
Concep II/Apron	5.0a	12.5a	12.7ab	61.0	6.0a	11.3a	10.8b	66.0a	6.0a	11.3a
Dual										
Unsafened	5.0a	3.3b	7.2b	66.0	9.0b	1.5b	4.5b	67.0a	14.0a	1.2c
Screen	5.0a	13.2a	13.5a	62.0	6.0a	11.4a	12.1a	66.0a	6.0b	7.7b
Concep II	5.0a	12.1a	12.7a	62.0	6.0a	11.5a	11.2a	67.0a	6.0b	8.7ab
Concep II/Apron	5.0a	11.9a	12.6a	62.0	6.0a	12.3a	12.5a	63.0b	6.0b	10.1a
Lasso										
Unsafened	5.0a	3.2b	7.7b	65.0	14.0c	0.0b	0.0c	0.0c	14.0a	0.0d
Screen	5.0a	11.6a	12.6a	62.8	6.0a	12.1a	12.5a	63.0b	7.0b	7.4b
Concep II	5.0a	12.5a	13.5a	62.7	6.0b	11.1a	10.7b	67.0a	7.0b	5.5c
Concep II/Apron	5.0a	11.5a	13.5a	62.0	6.0ab	11.7a	12.2ab	63.0b	6.0b	10.6a

<sup>a</sup>Concep II was applied alone and in combination with the fungicide Apron.

<sup>b</sup>Means of each column followed by a different letter within each herbicide and year are significantly different at the P<0.05 LSD.

**Table 42. Days from planting to half-bloom of grain sorghum hybrids as influenced by seed safener application in 1987 at Manhattan, KS.**

Hybrid	Unsafened	Screen	Concep II	Concep II/Apron
			(days)	
Asgrow Chapparral	63.6b <sup>a</sup>	65.8a	62.2b	62.0b
Asgrow GS75311	62.2b	67.9a	61.6b	62.1b
DeKalb 18	52.1a	53.4a	52.1a	52.1a
DeKalb 40	60.4a	62.1a	60.3a	60.8a
DeKalb 42Y	64.3b	66.8a	62.8b	63.4b
Funk's G550	61.2a	61.4a	61.3a	61.3a
Funk's HW3177	52.6a	53.2a	52.0a	52.1a
Funk's HW7217	61.8a	62.0a	61.8a	61.8a
G. Harvest H501	60.4a	61.2a	60.7a	60.6a
G. Harvest H505	62.9b	64.8a	62.7b	62.4b
G. Harvest H510	61.3a	62.4a	61.2a	61.3a
NC+ 172	61.1a	61.1a	61.6a	61.1a
NC+ 174	63.4a	62.9a	63.4a	63.5a
NC+ 271	62.3a	62.1a	62.0a	62.4a
Northrup King 2656	61.8b	65.9a	60.4b	60.4b
Northrup King 2778	61.6b	64.0a	61.8b	61.8b
Northrup King 9740Y	63.1a	62.9a	62.8a	63.0a
Pioneer 8358	62.1b	65.2a	61.9b	62.0b
Pioneer 8493	60.8b	69.6a	60.4b	60.6b
Pioneer 8686	56.9a	57.3a	56.4a	56.3

<sup>a</sup>Means followed different letters within a row are significantly different at P<0.05 LSD.

**Table 43. Days from planting to half-bloom of grain sorghum as affected by herbicide and seed treatment applications<sup>a</sup> in 1987 at Manhattan, KS.**

Herbicide	Seed Safener	Half-bloom <sup>b</sup>
		(days)
None	Unsafened	59.9a <sup>b</sup>
	Screen	60.4a
	Concep II	59.9a
	Concep II/Apron	59.9a
Dual	Unsafened	61.3b
	Screen	63.5a
	Concep II	60.7b
	Concep II/Apron	60.8b
Lasso	Unsafened	61.3b
	Screen	63.9a
	Concep II	60.9b
	Concep II/Apron	60.9b

<sup>a</sup>Means followed by a common letter are not significantly different at the P<0.05 LSD.

<sup>b</sup>Averaged across all hybrids.



**Agricultural Experiment Station, Kansas State University, Manhattan 66506-4008**

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