12/2/1993

DATA EVALUATION RECORD

1. **CHEMICAL:** Oxyfluorofen.
Shaughnessey No. 111601.

2. **TEST MATERIAL:** Goal technical (oxyfluorofen); 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene; Lot No. 2-0956; CAS No. 42874-03-3; 71.5% purity; a brown crystal.

3. **STUDY TYPE:** Non-Target Plants: Seed Germination, Seedling Emergence & Vegetative Vigor Phytotoxicity Test - Tier 2. Species Tested: Soybean, Lettuce, Carrot, Tomato, Cucumber, Cabbage, Oat, Ryegrass, Corn, and Onion. 123-1(a)(b)

4. **CITATION:** Hoberg, J.R. 1990. (Goal Technical) - Determination of Effects on Seed Germination, Seedling Emergence and Vegetative Vigor of Ten Plant Species. Laboratory Report No. 90-7-3373. Conducted by Springborn Laboratories, Inc., Wareham, MA. Submitted by Rohm and Haas Company, Spring House, PA. EPA MRID No. 416440-01.

5. **REVIEWED BY:**

Mark A. Mossler, M.S.
Agronomist
KBN Engineering and
Applied Sciences, Inc.

Signature: Mark A. Mossler

Date: 5/20/91

Charles Lee
6/13/91

6. **APPROVED BY:**

Pim Kosalwat, Ph.D.
Senior Scientist
KBN Engineering and
Applied Sciences, Inc.

Signature: P. Kosalwat

Date: 5/20/91

Henry T. Craven, M.S.
Supervisor, EEB/HED
USEPA

Signature: Henry T. Craven

Date: 12/2/93

32 hours

7. **CONCLUSIONS:**

Seed Germination: This study is not scientifically sound and does not meet the requirements for a Tier 2 seed germination test using non-target plants. Some poor performance replicates were selectively excluded from the test results. Carrot demonstrated a significant reduction in percent germination when treated with the highest rate of oxyfluorofen. Treatment of the tomato seeds with 25% of the maximum rate of oxyfluorofen did not significantly affect germination. However, rates above 0.5 lb ai/A were not investigated. The NOEC for tomato was therefore greater than 0.5 lb ai/A. The NOEC for carrot was 2.3 mg ai/l. The NOEC values for the remaining eight species were the maximum rates tested.

Only carrot and tomato demonstrated significant reductions in radicle length at some rate of oxyfluorofen tested. The subsequent NOEC values for these two species were 2.3 and 0.072 lb ai/A, respectively. The NOEC values for the remaining species were the maximum rates tested.

The EC_{25} and EC_{50} values for tomato radicle length obtained by the reviewer are slightly less than the author's (0.371 and 1.0 mg ai/l, respectively). Table 33 (attached) lists the EC values for the the remaining species.

Seedling Emergence: This study is scientifically sound but does not meet the requirements for a Tier 2 seedling emergence test using non-target plants. For percent emergence, all species except lettuce had NOEC values that were the maximum rate tested, however, the maximum rate tested was never the maximum labeled rate. The most sensitive species was lettuce with an NOEC of 0.0074 lb ai/A. The most tolerant species was soybean with an NOEC value of 2.2 lb ai/A.

All species except carrot demonstrated significant shoot length reductions from oxyfluorofen application at some rate tested. The most sensitive species were cabbage, lettuce, onion, and ryegrass with an NOEC value of 0.0024 lb ai/A. The most tolerant species was soybean with an NOEC value of 0.31 lb ai/A.

The EC_{25} and EC_{50} values for ryegrass shoot length obtained by the reviewer are slightly less than the author's (0.0031 and 0.007 lb ai/A, respectively). Table 34 (attached) lists the EC values for the emergence study.

Vegetative Vigor: This study is scientifically sound but does not meet the requirements for a Tier 2 vegetative vigor test using non-target plants. All species except ryegrass demonstrated significant reductions in shoot length and shoot dry weight. The most sensitive species for both parameters was tomato with an NOEC value of 0.00066 lb ai/A. Corn was the most tolerant species with NOEC values of 0.034 and 0.14 lb ai/A for shoot length and weight, respectively. All species except cucumber and tomato demonstrated no significant reductions in root dry weight. The most sensitive species was tomato with an NOEC of 0.00066 lb ai/A. The most tolerant species was corn, with an NOEC of 0.47 lb ai/A. Table 35 (attached) lists the EC values for the vegetative vigor tests.

8. **RECOMMENDATIONS:** N/A.

9. **BACKGROUND:** N/A.

10. **DISCUSSION OF INDIVIDUAL TESTS:** N/A.

11. **MATERIALS AND METHODS:**

A. **Test Plants:**
Dicotyledon plants were represented by six species from six families (i.e., soybean, lettuce, carrot, tomato, cucumber, and cabbage). Monocotyledon plants were represented by four species from two families (i.e., corn, oat, ryegrass, and onion). Cultivars, lot number, and germination ratings (except for three species) were provided in the report.

B. **Test System:**
Seed Germination: Two circles of filter paper were placed in the bottom of a glass petri plate (150 mm in diameter and 20 mm in height). The filter paper was saturated with 5 ml of the appropriate test solution in 100% acetone, which was allowed to dry under a fume hood for 5 minutes. The treatment plates then received 15 ml of deionized water. Solvent control plates received 5 ml acetone which was allowed to evaporate. Both control plates then received 15 ml of deionized water.

Twenty seeds of each crop were added to each petri plate after the test solution was absorbed into the paper. The plates were randomly placed in an incubator

set at 30 ±1°C for corn, cucumber, and oat; and 22 ±1°C for the remaining species.

Seedling Emergence: Ten seeds of each crop were planted in plastic pots filled with 1.5 kg of sand. Each pot was moistened with 200 ml of nutrient solution. All seeds were planted at a depth of 1 cm. After planting, 200 ml of the solvent control/nutrient solution was added to solvent control pots. Appropriate test doses were prepared in 200 ml of nutrient solution and added to the sand in each treatment pot by subirrigation. Nutrient solution at half-strength was applied during the course of the study to all species except carrot, lettuce, and onion which received one-quarter strength nutrient solution.

Vegetative Vigor: Approximately 200 seeds of each species were germinated in moist towels that were placed in sealed aquaria and kept in a growth chamber. Corn, oat, and tomato seeds were allowed to germinate for three days. Soybean seeds were allowed to germinate for four days. Cabbage, cucumber, lettuce, and ryegrass were allowed to germinate five days, and onion and carrot seeds were allowed to germinate for seven days. After germination but prior to planting, all seedlings except corn, oat, and tomato were exposed to 150 footcandles of artificial light for several hours to allow for proper orientation of root and shoot portions of the seedlings and to initiate photosynthesis. Corn and oat were exposed to 16 hours of light at approximately 500 footcandles while tomato received four 16-hour periods of this same intensity illumination. Five seedlings were placed in each pot for all species. The pots received 200-250 ml of nutrient solution. Oxyfluorofen was sprayed onto established plants 10 days after germination. Applications were made from lowest to highest concentration with a hand spraying apparatus. Treatments included both a control and a solvent control (1:10 methanol to distilled water). The test material was allowed to dry and the pots were placed on trays and randomized. Nutrient solution at half-strength was applied during the course of the study to all species except carrot, lettuce, and onion which received one-quarter strength nutrient solution.

C. **Dosage:** Oxyfluorofen was applied at the nominal rates of 0, 0.38, 0.75, 1.5, 3.0, and 6.0 mg ai/l to all plant species except for tomato, which received 0, 0.095, 0.19, 0.38, 0.75, and 1.5 mg ai/l for the seed

germination test. For the seedling emergence and vegetative vigor tests, nominal concentrations ranged between 0.00026 to 1.6 lb ai/A. Table 2 (attached) lists concentrations for all test species. Stock solutions were measured by gas chromatography (GC) for the seed germination test. Nutrient or spray solutions from the emergence and vigor test, respectively, were monitored for oxyfluorofen by GC. The concentration of material in the test solutions was recorded (Table 2). Experimental data were not adjusted for percent recovery. Treatment application rates were adjusted for the percent purity of the test material (71.5%).

D. **Design:**

Seed Germination: Each treatment/crop combination was replicated three times (i.e., 20 seeds/plate, 3 plates/treatment). After 5 days of incubation (6 for carrot), the seeds were removed from the petri plates and the radicle lengths were measured to the nearest millimeter. Percent seed germination and mean radicle length were calculated for all germinated seeds. Seeds were considered germinated if the radicle was at least 3 mm long. Seeds were observed for morphological abnormalities such as discoloration, swelling or lesions.

Seedling Emergence: Each crop/treatment combination was replicated three times (i.e., 10 seeds/pot, 3 pots/treatment level). At 10 and 14 days, each replicate pot was observed for abnormalities such as scalding, wilting, mildew, chlorosis, leaf blotch, foliar lesions and necrosis. The percentage of the ten seeds planted in each pot which emerged was calculated for each treatment. The shoot length was also recorded at 14 days (test termination).

Vegetative Vigor: Individual shoot lengths were measured and recorded on the day prior to the application of oxyfluorofen for cabbage, carrot, cucumber, lettuce, onion, ryegrass, and soybean. Corn, oat, and tomato seedlings were measured just prior to oxyfluorofen application. All plants were measured weekly thereafter. Observations of morphological abnormalities were also made on the same days. Fourteen days after treatment, the plants within treatment replicates (pots) were cut at the soil level and dried at 70°C for several days. After drying, the dry weights of the individual shoots were recorded. Roots were removed from sand, rinsed in deionized water, oven dried and weighed in the same manner as the

shoots. Roots were combined as a group dry weight per replicate pot.

Temperature, relative humidity, light intensity, and carbon dioxide measured during the period of growth were provided in the report.

E. **Statistics:** Solvent control data were first compared to the control data using Student's test ($p< 0.05$). If control and solvent data were significantly different, then treatment data were compared to the solvent control data. If no significant difference was found, control and solvent control data were pooled before further analysis with treatment data. For Tier 2 tests, the solvent control and control were treated as mentioned above. Data were then tested for normality by a Chi-square test and for homogeneity of variance using Bartlett's test. If the assumptions of normality and homogeneity of variance were not met, the data were transformed and analyzed further if those assumptions could then be satisfied. Data not meeting the assumption of homogeneity of variance or normality were statistically analyzed for significant effects using the non-parametric Kruskal-Wallis test. If data met the assumption of homogeneity of variance and normality using the pooled control data, then Bonferroni's test was performed in order to determine statistically significant reduction effects. If solvent control data were used, then Dunnett's test was performed. All statistical conclusions were made at the 95% level of certainty. These statistical procedures were followed using data from each measured parameter to determine the no-observed-effect concentration (NOEC) for each parameter.

The EC_{25} and EC_{50} values were calculated by linear regression of response versus exposure concentration. The regressions were limited to the concentration range for which a clear exposure response relationship was observed. "Tails" at both ends of the exposure response curve were not included in the analyses, based on the judgement of the Study Director. Four linear regression curves were computed based on (a) untransformed data, (b) untransformed response vs. logarithm transformed concentration, (c) probit transformed response vs. untransformed concentration, and (d) probit transformed response vs. logarithm transformed concentration. Based on the highest coefficient of determination, the regression line that

provided the best fit of the untransformed or transformed data was selected. This regression equation was then applied to calculate the EC_{25} and EC_{50} values and their 95% confidence limits, using the method of inverse prediction.

The NOEC values determined for some species were greater than the corresponding EC_{25} values, due to the variability within the data such that the mean measured values of some treatment parameters were not significantly different from the control data. Though a parameter may have been reduced by >25% during a test as compared to the solvent control or pooled control, the reduction may not have been statistically significant.

Seed Germination: At test termination, the number of seeds germinated and percent germination were determined for each replicate, along with the mean value, standard deviation and 95% confidence interval for each test concentration, solvent control and control. The mean, standard deviation and 95% confidence limits for radicle lengths were also calculated per replicate for each concentration, solvent control and control. For statistical analyses of percent germination and radicle length, data were compared on a per replicate basis, three observations per treatment or control. Individual radicle lengths measured in each of the three replicates were averaged prior to analysis. All comparisons were made to either the pooled controls or solvent control data, depending upon whether the solvent control and control were similar or different.

Seedling Emergence: At test days 10 and 14 (test termination), the number and percentage of the seedlings emerged were determined for each replicate. The mean value, standard deviation and 95% confidence intervals for each test concentration, solvent control and control were determined for percent emergence and shoot length at test termination. During statistical analyses, data were compared on a per replicate basis, three observations per treatment or control. All comparisons were made to either the pooled controls or solvent control data, depending upon whether they were significantly different.

Vegetative Vigor: At the conclusion of the test period, data obtained from measurements of shoot

length, shoot weight, and root weight were statistically analyzed to establish if the exposure to oxyfluorofen adversely affected plant development. All statistical comparisons of the treatment data were made against either the solvent control or pooled control data, depending upon whether the solvent control and control were statistically similar or different, respectively. Replicate mean values for shoot length and shoot weight, calculated from individual observations, were used during the statistical analyses. Replicate mean root weight values were calculated from combined replicate observations and used during the statistical analyses.

12. **REPORTED RESULTS:**

Seed Germination: All rates reported are based on measured concentrations. No significant ($p< 0.05$) difference in percent germination existed for any species except carrot, which was significantly affected at 4.6 mg ai/l. The NOEC value for percent germination was 4.6 mg ai/l for cabbage, lettuce, ryegrass, and soybean; 4.5 mg ai/l for corn, cucumber, and oat; 2.9 mg ai/l for onion; and 2.3 mg ai/l for carrot. Tomato demonstrated an NOEC value of 1.5 mg ai/l. The NOEC value for percent germination for tomato was not less than 1.5 mg ai/l, but was not investigated above this level to the maximum rate of 6.0 mg ai/l. The EC_{25} and EC_{50} values for percent germination were greater than the maximum rates tested for all species, except tomato, in which case the EC values were greater than 1.5 mg ai/l (0.5 lb ai/A).

Radicle length of carrot was significantly reduced when compared to controls for the 4.6 mg ai/l concentration. Tomato was significantly affected at the 1.5, 0.70, and 0.37 mg ai/l rates of oxyfluorofen when compared to pooled control data. Although non-significant, cabbage and oat demonstrated 34 and 46% reduction in radicle length at some tested rate of oxyfluorofen, respectively. This outlying value for oat was not used in the statistical analysis. The EC values are summarized in Table 33 (attached). The NOEC values for tomato and carrot were 0.15 and 2.3 mg ai/l, respectively. The NOEC value for radicle length for the remaining species was the maximum rate tested (i.e., 4.6 mg ai/l for cabbage, lettuce, ryegrass, and soybean; 4.5 mg ai/l for corn, cucumber, and oat; and 2.9 mg ai/l for onion).

Seedling Emergence: All rates reported are based on measured concentrations. By day 14 (test termination)

percent emergence for all species except lettuce, did not differ significantly ($p< 0.05$) from the controls for the highest rate tested. The subsequent NOEC values (in lb ai/A) for the ten species, in increasing sensitivity, are:

soybean (2.2) < tomato (0.31) < corn (0.23) < oat (0.16) < carrot (0.084) < cucumber = onion = ryegrass (0.026) < cabbage (0.021) < lettuce (0.0074).

By day 14, shoot length was significantly affected by some rate of oxyfluorofen tested for all species except carrot. At the highest rate of oxyfluorofen tested, only one carrot plant out of all three replicates remained, however, the length was not significantly different from the pooled control data. Therefore, these data were left out of statistical analysis and the next lower rate (0.051 lb ai/A) was taken to be the NOEC value for carrot. The NOEC values (in lb ai/A) for the remaining nine species, in increasing sensitivity, are:

soybean (0.31) < corn (0.084) < tomato (0.012) < cucumber = oat (0.0074) < cabbage = lettuce = onion = ryegrass (0.0024).

The EC values are summarized in Table 34 (attached).

Vegetative Vigor: All rates reported are based on measured concentrations. Table 35 (attached) summarizes the EC_{25} and EC_{50} values from the vegetative vigor tests using non-target plant species. All species except ryegrass demonstrated significant reductions in shoot length at some tested concentration of oxyfluorofen when compared to the pooled control data. The NOEC values (in lb ai/A) for the ten test species, in increasing sensitivity, are:

corn = carrot (0.034) < ryegrass (0.014) < oat (0.012) < soybean = lettuce = onion (0.0071) < cabbage (0.0037) < cucumber (0.0017) < tomato (0.00066).

All species demonstrated significant reductions in shoot dry weight at some tested concentration of oxyfluorofen when compared to the pooled control data. The NOEC values (in lb ai/A) for the ten species, in increasing sensitivity, are:

corn (0.14) < oat (0.061) < carrot (0.034) < lettuce = onion = ryegrass (0.0071) < cabbage (0.0037) < cucumber = soybean (0.0017) < tomato (0.00066).

By day 14 (test termination) dry root weight for all species except cucumber and tomato did not differ significantly ($p< 0.05$) from the controls for the highest rate tested. The subsequent NOEC values (in lb ai/A) for the ten tested species, in increasing sensitivity, are:

corn (0.47) < carrot (0.12) < oat (0.10) < soybean (0.034) < lettuce = onion = ryegrass (0.014) < cabbage (0.010) < cucumber (0.0017) < tomato (0.00066).

13. STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:

"Based on the results of all three life stage tests (germination, emergence and vigor), cabbage, lettuce, onion, and ryegrass were determined to be most sensitive to the toxicity of Goal technical during the seedling emergence test, with calculated shoot length EC_{25} values of 0.0026, 0.0027, 0.0038 and 0.0058 lbs/acre, respectively.

Carrot, corn, cucumber, oat, soybean and tomato were found to be most affected by the exposure to Goal technical during the vegetative vigor test. Shoot weight was determined to be the most sensitive parameter to the toxicity of Goal technical for carrot, corn, soybean and tomato, with calculated EC_{25} values of 0.027, 0.095, 0.012 and 0.00043 lbs/acre, respectively. For cucumber, shoot weight and root weight were determined to be equally sensitive to the toxicity of Goal technical, each having a calculated EC_{25} value of 0.0017 lbs/acre. Root weight was determined to be the most sensitive parameter to the toxicity of Goal technical for oat, with a calculated EC_{25} value of 0.007 lbs/acre. Tomato was determined to be the most sensitive species to the toxicity of Goal technical since it was the most sensitive species during both seed germination and vegetative vigor tests."

The Quality Assurance Unit of Springborn Laboratories, Inc., was responsible for the assurance of compliance with Good Laboratory Practice (GLP) Standards. Both statements of compliance with GLPs and QA were enclosed.

14. REVIEWER'S DISCUSSION AND INTERPRETATION OF STUDY RESULTS:

A. Test Procedure:

Seed Germination: In the percent germination studies, seeds are considered germinated when the radicle length is 3 mm or greater. Subdivision J guidelines call for

a minimum length of 5 mm when considering a seed germinated.

In the case of tomato percent germination, the NOEC and EC values are greater than 1.5 mg ai/l (0.5 lb ai/A), but the author did not test above this level to the maximum application rate of 2.0 lb ai/A.

The EC values for both parameters (percent germination and radicle length) for all species except cabbage, carrot, oat, and tomato radicle length were never calculated because of the lack of responses at the rates tested. However, the rates tested were not the maximum rate of 2.0 lb ai/A (6.0 mg ai/l).

Although not significant, oat, and cabbage radicle length data were subjected to probit analysis to predict both EC_{25} and EC_{50} values. Since the response by both species was less than 50%, the EC_{50} values are not considered valid by the reviewer. In addition, the R^2 for both of these equations indicates a poor fit of the data. Therefore, the only valid EC_{50} values are those for tomato and carrot.

Seedling Emergence: Although mention was made concerning the physical state of the test plants, no rating scale was used to quantify this injury.

For percent emergence, the EC values could not be calculated due to the lack of responses by all species at the rates tested. However, the rates tested were not the maximum rate (2.0 lb ai/A). The NOEC value for corn (2.2 lb ai/A) demonstrates that the EC values would be above 2.0 lb ai/A. Subsequently, this is the only species which has valid EC values reported.

Tables 13 through 22 in the report have mean measured concentration (mg/kg) above the head of the first column. This should read adjusted test concentration (lb ai/A).

Individual plant heights should be used for the statistical analysis instead of replicate means.

Vegetative Vigor: Again, although mention was made concerning the physical state of the test plants, no rating scale was used to quantify the injury.

The dilution progression for corn and tomato for this portion of the test was 2.5x. The subdivision J guidelines state that the dilutions must be no more than two-fold.

For the shoot length portion of the study, cabbage should be tested at higher rates to evince a rate response to calculate EC values.

For the shoot dry weight portion of the study, cabbage again should be retested at higher rates to calculate EC values. In addition, the reviewer believes that the NOEC for lettuce should be 0.0017 lb ai/A rather than 0.0071 lb ai/A. The percent inhibition at 0.0037 lb ai/A is 63%, which leads the reviewer to believe that the lower rate of 0.0017 lb ai/A should be accepted as the NOEC.

For the root dry weight portion of the study, both carrot and onion should be retested at higher rates to determine the EC values.

Individual shoot heights and weights should be used for the statistical analysis instead of replicate mean values.

B. **Statistical Analysis:** Statistical analysis was conducted on tomato radicle length (the most sensitive species) for the seed germination test. The NOEC obtained by the reviewer (attached) is lower than the author's with a value of 0.072 lb ai/A. The EC_{25} and EC_{50} values for tomato radicle length obtained by the reviewer (attached) were 0.371 and 1.0 mg/l, respectively. These are also lower than those obtained by the author. Consequently, the more conservative values obtained by the reviewer will be used as the NOEC, EC_{25}, and EC_{50} values for tomato radicle length.

Statistical analysis was conducted on ryegrass shoot length (one of the most sensitive species) for the seedling emergence test. The NOEC obtained by the reviewer is in agreement with the author's (0.0024 lb ai/A). The EC_{25} and EC_{50} values for ryegrass shoot length obtained by the reviewer were 0.0031 and 0.007 lb ai/A, respectively. These values are lower than those obtained by the author. Consequently, the more conservative values obtained by the reviewer will be used as the NOEC, EC_{25}, and EC_{50} values for ryegrass shoot length.

Statistical analysis was conducted on tomato root weight (one of the most sensitive species parameters) for the vegetative vigor test. The results obtained by the reviewer are in general agreement with the author's.

C. **Discussion/Results:**

Seed Germination: The following replicates were eliminated from the test results by the author due to unusually poor germination: one cucumber replicate in the control and 1.2 mg ai/l level, and one oat replicate in the control and four lowest treatment levels. This practice is not considered scientifically sound since the author selectively included only expected results. Poor performance in the control plants might be an indication of poor materials and methods used in the test, which should have been repeated.

Treatment of seed with oxyfluorofen up to the maximum application rate did not have any significant effect on percent germination of any species except carrot when compared to pooled control data. Tomato was tested with oxyfluorofen only up to 1.5 mg ai/l (0.5 lb ai/A). At this maximum tested rate, no significant reductions in percent germination were observed, however, this was only 25 percent of the maximum labeled rate. Therefore, the NOEC value for tomato is 0.5 lb ai/A. Because higher rates of oxyfluorofen were not tested, it is not possible to determine which species is the most sensitive to oxyfluorofen with respect to percent germination. The EC values were all above the maximum rate tested.

Both carrot and tomato radicle length were significantly affected by oxyfluorofen application at some tested rates. The most sensitive species was tomato with an NOEC value of 0.072 mg ai/l. Carrot was less sensitive to oxyfluorofen with an NOEC of 2.3 mg ai/l. The NOEC for the remaining species was the maximum measured rate tested.

The EC_{25} and EC_{50} values for tomato radicle length were 0.371 and 1.0 mg ai/l, respectively. The EC values for the remaining species are listed in Table 33 (attached).

Seedling Emergence:
Percentage of Emerged Seedlings: By test termination, percent emergence for all species, except lettuce, did not differ from the pooled control data. Lettuce was the most sensitive species with an NOEC value of 0.0074 lb ai/A. Soybean was the most tolerant to oxyfluorofen application with an NOEC value of 2.2 lb ai/A. The EC values for percent emergence were all above the maximum rate tested.

Shoot Length: By test termination, all species were affected by oxyfluorofen at some tested rates. Cabbage, lettuce, onion, and ryegrass were equally sensitive to oxyfluorofen with an NOEC value of 0.0024 lb ai/A. Soybean was the most tolerant species with an NOEC of 0.31 lb ai/A.

The EC_{25} and EC_{50} values for ryegrass shoot length were 0.0031 and 0.0071lb ai/A, respectively. The EC values for the remaining species are listed in Table 34 (attached).

Vegetative Vigor:
Shoot Length: The most sensitive species with respect to shoot length was tomato, with an NOEC value of 0.00066 lb ai/A. The most tolerant species was corn with an NOEC value of 0.034 lb ai/A.

Shoot Weight: All species demonstrated significant reductions in dry weight at some tested concentrations of oxyfluorofen. The most sensitive species was again tomato with an NOEC value of 0.00066 lb ai/A. The most tolerant species with respect to shoot weight was again corn, with an NOEC value of 0.14 lb ai/A.

The author states that the NOEC value for lettuce shoot weight was 0.0071 lb ai/A. Review of the statistical results indicate that the rate of 0.0037 lb ai/A of oxyfluorofen significantly reduced shoot weight. Therefore, the NOEC for lettuce shoot weight should be reported as 0.0017 lb ai/A.

Root Weight: The most sensitive species with respect to root weight was tomato. The NOEC value for tomato was 0.00066 lb ai/A. The most tolerant species was corn with an NOEC value of 0.47 lb ai/A.

The EC_{25} and EC_{50} values for tomato root weight were 0.00071 and 0.0013 lb ai/A, respectively. The EC

values for the remaining species and parameters are listed in Table 35 (attached).

The author states that the most sensitive parameter for lettuce in the vegetative vigor test was root weight. The most sensitive parameter for lettuce is actually shoot weight.

These studies do not fulfill the guideline requirements for Tier 2 seed germination/seedling emergence or vegetative vigor tests using non-target plants.

D. **Adequacy of the Study:**

(1) **Classification:** Seed Germination - Invalid.
Seedling Emergence - Supplemental.
Vegetative Vigor - Supplemental.

(2) **Rationale:** The study did not follow the approved protocol for measuring radicles in the seed germination study. Some poorly germinating replicates were selectively excluded from the test results. Tomato was not tested at a high enough concentration. The EC_{50} values for oat and cabbage were not based on proper data. Also, protocol deviation #4 places this study in the invalid category.

For the emergence studies, NOEC values were not reached for percent emergence for nine of the ten tested species. The highest tested rate for these species was below the maximum labelled rate.

In the vegetative vigor tests, a 2.5x dilution progression was used on the corn and tomato plants. The maximum dilution progression allowed is two-fold. Cabbage, carrot, and oat should be retested with higher rates of oxyfluorofen to determine EC values for all parameters tested.

(3) **Repairability:** No.

15. **COMPLETION OF ONE-LINER:** N/A.

RIN 0637-00

EFED Review - Oxyfluorfen

Page____ is not included in this copy.

Pages 16 through 30 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

X FIFRA registration data.

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tomato radicle length

Summary Statistics and ANOVA

Transformation = None

Group	n	Mean	s.d.	cv%
1 = control	30	15.3667	3.3165	21.6
2	30	14.5333	3.8213	26.3
3*	30	13.4000	4.1072	30.7
4*	30	12.0000	2.5596	21.3
5*	30	10.1000	2.9402	29.1
6*	30	10.7000	2.1034	19.7

rate (mg ai/L - measured concentrations)

2) = 0.072
3) = 0.15
4) = 0.37
5) = 0.70
6) = 1.5

*) the mean for this group is significantly less than the control mean at alpha = 0.05 (1-sided) by Dunnett's test

NOEC = 0.072 lb ai/A.

Minumum detectable difference for Dunnett's test = -1.852240
This difference corresponds to -12.05 percent of control

Between groups sum of squares = 666.316667 with 5 degrees of freedom.

Error mean square = 10.348467 with ** degrees of freedom.

Bartlett's test p-value for equality of variances = .004

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* *
* Warning - the test for equality of variances *
* is significant (p less than 0.01). The *
* results of this analysis should be inter- *
* preted with caution. *
* *
****

tomato radicle length

Estimated EC Values and Confidence Limits

Point	Conc. (mg/l)	Lower 95% Confidence Limits	Upper 95% Confidence Limits
EC 1.00	0.0323	0.0113	0.0577
EC 5.00	0.0884	0.0466	0.1279
EC10.00	0.1513	0.0977	0.1986
EC15.00	0.2174	0.1580	0.2727
EC50.00	1.0056	0.7344	1.7070
EC85.00	4.6519	2.4708	14.7607
EC90.00	6.6836	3.2751	24.7186
EC95.00	11.4339	4.9661	53.1307
EC99.00	31.3005	10.8158	223.7141

$Y = 5.0 + 1.56(X)$

Y = % probit inhibition

X = log (rate)

$EC_{25} = 0.371$ mg/l

ryegrass shoot length
File: rye Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	1009.094	201.819	8.131
Within (Error)	87	2159.524	24.822	
Total	92	3168.618		

Critical F value = 2.37 (0.05,5,60)
Since F > Critical F REJECT Ho:All groups equal

ryegrass shoot length
File: rye Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	rate (lb ai/A) control	16.917	16.917		
2	0.0024	15.750	15.750	0.842	
3	0.0033	11.833	11.833	3.534	*
4	0.0074	9.357	9.357	3.532	*
5	0.021	5.500	5.500	5.020	*
6	0.026	11.250	11.250	2.106	

Bonferroni T table value = 2.37 (1 Tailed Value, P=0.05, df=80,5)

NOEC = 0.0024 lb ai/A.

rate (lb ai/A)
1 = control
2 = 0.0024
3 = 0.0033
4 = 0.0074
5 = 0.021
6 = 0.026

ryegrass shoot length
File: rye Transform: NO TRANSFORMATION

BONFERRONI T-TEST - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	control	24			
2	0.0016	28	3.290	19.4	1.167
3	0.0031	24	3.414	20.2	5.083
4	0.0063	7	5.081	30.0	7.560
5	0.013	6	5.399	31.9	11.417
6	0.025	4	6.388	37.8	5.667

ryegrass shoot length
File: rye Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F

ryegrass shoot length

Estimated EC Values and Confidence Limits

Point	Conc.	Lower 95% Confidence Limits	Upper 95% Confidence Limits
EC 1.00	0.0004	0.0002	0.0007
EC 5.00	0.0010	0.0006	0.0014
EC10.00	0.0015	0.0010	0.0020
EC15.00	0.0020	0.0015	0.0025
EC50.00	0.0070	0.0060	0.0086
EC85.00	0.0245	0.0178	0.0397
EC90.00	0.0330	0.0228	0.0576
EC95.00	0.0511	0.0328	0.1005
EC99.00	0.1161	0.0648	0.2860

$Y = 9.11 + 1.91(X)$

Y = % probit inhibition

X = log (rate)

$EC_{25} = 0.0031$

Tomato root weight

Summary Statistics and ANOVA

Transformation = None

Group	n	Mean	s.d.	cv%
1 = control	3	.3767	.1231	32.7
2	3	.4790	.1811	37.8
3	3	.2153	.1080	50.2
4*	3	.1570	.0528	33.7
5*	3	.0607	.0015	2.5
6*	3	.0473	.0413	87.2

rate (lb ai/A) - measured concentrations

2) = 0.00024
3) = 0.00066
4) = 0.0015
5) = 0.004
6) = 0.0047

*) the mean for this group is significantly less than the control mean at alpha = 0.05 (1-sided) by Dunnett's test

NOEC = 0.00066 lb ai/A.

Minumum detectable difference for Dunnett's test = -.211010
This difference corresponds to -56.02 percent of control

Between groups sum of squares = .452323 with 5 degrees of freedom.

Error mean square = .010686 with 12 degrees of freedom.

Bartlett's test p-value for equality of variances = .004

```
************************************************
*                                              *
* Warning - the test for equality of variances *
* is significant (p less than 0.01).  The      *
* results of this analysis should be inter-    *
* preted with caution.                         *
*                                              *
************************************************
```

tomato root weight

Estimated EC Values and Confidence Limits

Point	Conc.	Lower 95% Confidence Limits	Upper 95% Confidence Limits
EC 1.00	0.0001	0.0000	0.0003
EC 5.00	0.0002	0.0000	0.0005
EC10.00	0.0003	0.0000	0.0006
EC15.00	0.0004	0.0001	0.0007
EC50.00	0.0012	0.0006	0.0022
EC85.00	0.0037	0.0020	0.0176
EC90.00	0.0048	0.0025	0.0314
EC95.00	0.0072	0.0034	0.0759
EC99.00	0.0151	0.0057	0.4108

$y = 2.11(x) + 11.16$

y = % probit inhibition

x = $\log$ (rate)

$EC_{25} = 0.00058$