(3-21-91) 3 Copy 121011

MRID No. 416851-03

DATA EVALUATION RECORD

1. **CHEMICAL:** Clethodim.
Shaughnessey No. 059639.

2. **TEST MATERIAL:** Select (Clethodim); CAS No. 99129-21-2; 82.4% purity; a brown-amber liquid.

3. **STUDY TYPE:** 122-1b Non-Target Plants: Vegetative Vigor Nontarget Phytotoxicity Study - Tier 1. Species Tested: Soybean, Lettuce, Carrot, Tomato, Cucumber, Cabbage.

4. **CITATION:** Maggio, R.M. 1990. Tier 1 Vegetative Vigor Nontarget Phytotoxicity Study Using SELECT (Clethodim). Laboratory Project No. LR 89-54A. Conducted by Pan-Agricultural Laboratories, Inc., Fresno, CA. Submitted by Valent, USA, Corporation, Walnut Creek, CA. EPA MRID No. 416851-03.

5. **REVIEWED By:**

Richard C. Petrie
Agronomist
EEB/EFED

Signature: Richard C. Petrie
Date: 3/21/91

6. **APPROVED BY:**

Charles Lewis, Acting Head,
Section 3,
EEB/EFED

Signature: Charles Lewis
Date: 3/22/91

7. **CONCLUSIONS:**

Vegetative Vigor: This study is scientifically sound and meets the requirements for a Tier 1 vegetative vigor test using non-target plants. Treatment of the plants with clethodim at the maximum application rate (0.25 lb ai/A) did

not have any significant negative effect on any plant species tested, except the height of tomato, after 21 days. A significant increase was observed in the dry weight of cabbage and lettuce treated with clethodim.

8. **RECOMMENDATIONS:** No further Tier I non-target phytotoxicity tests for vegetative vigor are required for clethodim.

9. **BACKGROUND:** Because clethodim is active on grasses only, the registrant was given the opportunity to demonstrate this by performing Tier I tests on dicot species only; as long as Tier II tests were conducted on the required monocot species.

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). Cultivars, lot number, and germination ratings were provided in the report.

B. **Test System:**

Seedling Establishment: Seeds of each crop were planted in plastic pots (7.5 x 7.5 x 6.0 cm) and filled with a sterilized soil mix. A plexiglass template was used to create planting holes in the soil, thus allowing for uniform planting depth and seed distribution. Soybean and cucumber were planted at a depth of 2.5 cm, while the remaining four species were planted at a depth of 1.3 cm. An analysis of the soil was provided in the report. After emergence, each pot was thinned to five plants/pot. The six plant species were allowed to grow for 9-16 days before treatment to allow each species to attain the 1-3 true leaf stage. Each treatment replicate was placed on an aluminum tray (6.125 x 31.125 cm). The spray plot was 3.21 x 1.67 ft (i.e., 5.36 ft^2).

All applications were performed with a belt sprayer equipped with a single nozzle. A nozzle height of 12 inches and a nozzle pressure of 50 psi were used. The test spray solutions were prepared by dissolving clethodim technical in deionized water and acetone.

2

The plants were sprayed at the equivalent of 468 L/ha (50 gpa) of water.

The pots were watered three times a day and a total of 25 ml of water was used to irrigate each pot per day.

C. **Dosage:** Clethodim was applied at a rate of 0.25 lb ai/A to all plant species. Treatment application rates were adjusted for the percent purity of the test material (82.4%).

D. **Design:** Each crop/treatment combination was replicated five times (i.e., 5 plants/pot, 5 pots/treatment level). After treatment, the pots were randomized within crops and among treatments and placed in an on-site greenhouse.

Plant height was measured by extending the seedling to its maximum height and recording the height to the nearest millimeter. The mean plant height was calculated for each treatment. Plant weight was evaluated at 21 days after application.

The phytotoxicity ratings evaluated five observable toxic effects: 0-indicates no effect; 1-indicates slight plant effect; 2-indicates a moderate effect (e.g., mild stunting or chlorosis); 3-indicates a severe effect; and 4-indicates a total effect or plant death.

Temperature, relative humidity, photoperiod, and illuminance during the period of growth were provided in the report.

E. **Statistics:** All data were entered into a Lotus 1-2-3 spreadsheet. The spreadsheet calculated replicate means, treatment means, standard deviations, and analysis of variance tables. Treatment means were used to calculate the percent effect resulting from the treatment. The percent effect was calculated using the following equation:

$$\% \text{ effect} = \frac{(\text{treatment mean} - \text{control mean})}{\text{control mean}} \times 100$$

Plant heights taken prior to treatment were used as a baseline to calculate the percent effect on growth at the 21 day observation period. The percent increase in height from the 0 day reading was calculated using the following equation:

$$\% \text{ increase} = \frac{(\text{21 day mean} - \text{0 day mean})}{\text{0 day mean}} \times 100$$

The percent effect on growth was calculated for each treatment using the following equation:

$$\% \text{ effect} = \frac{(\text{treat. \% increase} - \text{cont. \% increase})}{\text{control \% increase}} \times 100$$

An analysis of variance table was constructed using the Lotus 1-2-3 raw data spreadsheet. A one-way analysis of variance (ANOVA) model for data with equal sub-samples was used to analyze data from the phyto-toxicity, plant height and plant dry weight tests. The F-value from the analysis of variance table and a F table were used to determine if the treatment means were significantly different ($p < 0.05$).

12. **REPORTED RESULTS:**

Phytotoxicity rating: Statistical analysis of the 21 day phytotoxicity ratings shows no significant difference between control plants and those treated with clethodim. However, treatment of carrots with clethodim did result in a significant effect on mean phytotoxicity ratings at the 7 and 14 day observation periods.

Plant height: Treatment of plants with clethodim did result in a significant effect on tomato plant height at the 21 day observation period. The percent effect was -8%.

Plant dry weight: Statistical analysis of the plant dry weight data show no significant diffference between the control plants and those treated with clethodim. Dry weights ranged from 14% decrease for tomato to a 23% increase for cabbage and lettuce. After treatment with clethodim, cabbage and lettuce produced some vigorous plants which may have accounted for this increase.

13. **STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:** Clethodim applied at the maximum label rate of 0.25 lb ai/A did not result in a greater than 25% detrimental effect on any of the parameters measured in all systems.

The Quality Assurance Unit of Pan-Agricultural Labs, Inc., was responsible for the assurance of compliance with Good Laboratory Practice (GLP) Standards.

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

A. **Test Procedure:** The test procedures followed the SEP and Subdivision J guidelines, except for the following:

All plants in each replicate were weighed together, then the total weight was divided by the total number of plants to obtain each replicate mean value. The plants should have been individually weighed so the variation among plants within each replicate could be accounted for in the statistical analysis of the data.

B. **Statistical Analysis:** Statistical analyses were conducted on tomato (the most sensitive species) data for plant height (attached). The results are in near agreement with the author's.

C. **Discussion/Results:**

These studies are scientifically sound.

Phytotoxicity rating: Based on phytotoxicity ratings, all crops demonstrated no effect from clethodim application at 21 days after treatment. However, carrot did show significant ($p < 0.05$) signs of phytotoxicity at the 7 and 14 day observation periods.

Plant height: Only tomato was significantly ($p < 0.05$) affected by clethodim application after 21 days. The remainder of the species were not affected by the herbicide.

Plant dry weight: Plant dry weight was significantly ($p < 0.05$) affected in lettuce and cabbage. Both species demonstrated an increase in dry weight upon application of clethodim. Vigorous plant growth could have been responsible for this phenomena.

D. **Adequacy of the Study:**

(1) Classification: CORE

(2) Rationale:

(3) Repairability:

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

5

DATA EVALUATION RECORD

1. **CHEMICAL:** Clethodim.
Shaughnessey No. 059639.

2. **TEST MATERIAL:** Select (Clethodim); CAS No. 99129-21-2; 82.4% purity; a brown-amber liquid.

3. **STUDY TYPE:** Non-Target Plants: Vegetative Vigor Nontarget Phytotoxicity Study - Tier 1. Species Tested: Soybean, Lettuce, Carrot, Tomato, Cucumber, Cabbage.

4. **CITATION:** Maggio, R.M. 1990. Tier 1 Vegetative Vigor Nontarget Phytotoxicity Study Using SELECT (Clethodim). Laboratory Project No. LR 89-54A. Conducted by Pan-Agricultural Laboratories, Inc., Fresno, CA. Submitted by Valent, USA, Corporation, Walnut Creek, CA. EPA MRID No. 416851-03.

5. **REVIEWED By:**

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

Signature: Mark A. Mossler
Date: 2/26/91

6. **APPROVED BY:**

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

Signature: P. Kosalwat
Date: 2/26/91

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

Signature:
Date:

dupl C

10 hrs

6

7. **CONCLUSIONS:**

Vegetative Vigor: This study is scientifically sound, but does not meet the requirements for a Tier 1 vegetative vigor test using non-target plants due to the absence of four monocot species. Treatment of the plants with clethodim at the maximum application rate (0.25 lb ai/A) did not have any significant negative effect on any plant species tested, except the height of tomato, after 21 days. A significant increase was observed in the dry weight of cabbage and lettuce treated with clethodim.

8. **RECOMMENDATIONS:** Tests need to be performed that include the monocot species outlined in the SEP for Tier 1 testing.

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). Cultivars, lot number, and germination ratings were provided in the report.

B. **Test System:**

Seedling Establishment: Seeds of each crop were planted in plastic pots (7.5 x 7.5 x 6.0 cm) and filled with a sterilized soil mix. A plexiglass template was used to create planting holes in the soil, thus allowing for uniform planting depth and seed distribution. Soybean and cucumber were planted at a depth of 2.5 cm, while the remaining four species were planted at a depth of 1.3 cm. An analysis of the soil was provided in the report. After emergence, each pot was thinned to five plants/pot. The six plant species were allowed to grow for 9-16 days before treatment to allow each species to attain the 1-3 true leaf stage. Each treatment replicate was placed on an aluminum tray (6.125 x 31.125 cm). The spray plot was 3.21 x 1.67 ft (i.e., 5.36 ft^2).

7

All applications were performed with a belt sprayer equipped with a single nozzle. A nozzle height of 12 inches and a nozzle pressure of 50 psi were used. The test spray solutions were prepared by dissolving clethodim technical in deionized water and acetone. The plants were sprayed at the equivalent of 468 L/ha (50 gpa) of water.

The pots were watered three times a day and a total of 25 ml of water was used to irrigate each pot per day.

C. **Dosage:** Clethodim was applied at a rate of 0.25 lb ai/A to all plant species. Treatment application rates were adjusted for the percent purity of the test material (82.4%).

D. **Design:** Each crop/treatment combination was replicated five times (i.e., 5 plants/pot, 5 pots/treatment level). After treatment, the pots were randomized within crops and among treatments and placed in an on-site greenhouse.

Plant height was measured by extending the seedling to its maximum height and recording the height to the nearest millimeter. The mean plant height was calculated for each treatment. Plant weight was evaluated at 21 days after application.

The phytotoxicity ratings evaluated five observable toxic effects: 0-indicates no effect; 1-indicates slight plant effect; 2-indicates a moderate effect (e.g., mild stunting or chlorosis); 3-indicates a severe effect; and 4-indicates a total effect or plant death.

Temperature, relative humidity, photoperiod, and illuminance during the period of growth were provided in the report.

E. **Statistics:** All data were entered into a Lotus 1-2-3 spreadsheet. The spreadsheet calculated replicate means, treatment means, standard deviations, and analysis of variance tables. Treatment means were used to calculate the percent effect resulting from the treatment. The percent effect was calculated using the following equation:

$$\% \text{ effect} = \frac{(\text{treatment mean} - \text{control mean})}{\text{control mean}} \times 100$$

8

Plant heights taken prior to treatment were used as a baseline to calculate the percent effect on growth at the 21 day observation period. The percent increase in height from the 0 day reading was calculated using the following equation:

$$\% \text{ increase} = \frac{(\text{21 day mean} - \text{0 day mean})}{\text{0 day mean}} \times 100$$

The percent effect on growth was calculated for each treatment using the following equation:

$$\% \text{ effect} = \frac{(\text{treat. \% increase} - \text{cont. \% increase})}{\text{control \% increase}} \times 100$$

An analysis of variance table was constructed using the Lotus 1-2-3 raw data spreadsheet. A one-way analysis of variance (ANOVA) model for data with equal sub-samples was used to analyze data from the phyto-toxicity, plant height and plant dry weight tests. The F-value from the analysis of variance table and a F table were used to determine if the treatment means were significantly different ($p < 0.05$).

12. **REPORTED RESULTS:**

Phytotoxicity rating: Statistical analysis of the 21 day phytotoxicity ratings shows no significant difference between control plants and those treated with clethodim. However, treatment of carrots with clethodim did result in a significant effect on mean phytotoxicity ratings at the 7 and 14 day observation periods.

Plant height: Treatment of plants with clethodim did result in a significant effect on tomato plant height at the 21 day observation period. The percent effect was -8%.

Plant dry weight: Statistical analysis of the plant dry weight data show no significant diffference between the control plants and those treated with clethodim. Dry weights ranged from 14% decrease for tomato to a 23% increase for cabbage and lettuce. After treatment with clethodim, cabbage and lettuce produced some vigorous plants which may have accounted for this increase.

13. **STUDY AUTHOR'S CONCLUSIONS/QUALITY ASSURANCE MEASURES:** Clethodim applied at the maximum label rate of 0.25 lb ai/A did not result in a greater than 25% detrimental effect on

any of the parameters measured in all systems. Therefore, a Tier 2 study is not required.

The Quality Assurance Unit of Pan-Agricultural Labs, Inc., was responsible for the assurance of compliance with Good Laboratory Practice (GLP) Standards.

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

A. Test Procedure: The test procedures followed the SEP and Subdivision J guidelines, except for the following:

no monocots were used in this experiment. According to the SEP, a Tier 1 vegetative vigor test must contain ten species: six dicots and four monocots.

All plants in each replicate were weighed together, then the total weight was divided by the total number of plants to obtain each replicate mean value. The plants should have been individually weighed so the variation among plants within each replicate could be accounted for in the statistical analysis of the data.

The Herbicide Handbook (WSSA '89) lists the maximum label rate of clethodim as 0.6 lb ai/A. If this is the case, these tests need to be conducted again at this maximum rate.

B. Statistical Analysis: Statistical analyses were conducted on tomato (the most sensitive species) data for plant height (attached). The results are in near agreement with the author's.

C. Discussion/Results:

These studies are scientifically sound, but do not meet the requirements for Tier 1 vegetative vigor tests using non-target plants. Tests must be conducted in accordance with the SEPs which state that four monocot species must be evaluated.

Phytotoxicity rating: Based on phytotoxicity ratings, all crops demonstrated no effect from clethodim application at 21 days after treatment. However, carrot did show significant ($p < 0.05$) signs of phytotoxicity at the 7 and 14 day observation periods.

Plant height: Only tomato was significantly ($p < 0.05$) affected by clethodim application after 21 days. The

remainder of the species were not affected by the herbicide.

Plant dry weight: Plant dry weight was significantly ($p < 0.05$) affected in lettuce and cabbage. Both species demonstrated an increase in dry weight upon application of clethodim. Vigorous plant growth could have been responsible for this phenomena.

D. **Adequacy of the Study**:

(1) **Classification:** Supplemental.

(2) **Rationale:** The study did not follow the approved protocol for Tier 1 toxicity tests on vegetative vigor of non-target plants as listed in the SEP.

(3) **Repairability:** Additional tests should be conducted to include the four monocot species needed to comply with the SEP for Tier 1 testing.

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

11

OBS	TRT	REP	PLT	HT
1	1	1	1	150
2	1	1	2	159
3	1	1	3	165
4	1	1	4	181
5	1	1	5	190
6	1	2	1	151
7	1	2	2	148
8	1	2	3	144
9	1	2	4	150
10	1	2	5	158
11	1	3	1	140
12	1	3	2	150
13	1	3	3	145
14	1	3	4	151
15	1	3	5	132
16	1	4	1	123
17	1	4	2	187
18	1	4	3	148
19	1	4	4	160
20	1	4	5	164
21	1	5	1	153
22	1	5	2	172
23	1	5	3	156
24	1	5	4	161
25	1	5	5	154
26	2	1	1	137
27	2	1	2	159
28	2	1	3	161
29	2	1	4	167
30	2	1	5	133
31	2	2	1	180
32	2	2	2	180
33	2	2	3	195
34	2	2	4	178
35	2	2	5	191
36	2	3	1	131
37	2	3	2	149
38	2	3	3	144
39	2	3	4	151
40	2	3	5	150
41	2	4	1	199
42	2	4	2	171
43	2	4	3	203
44	2	4	4	186
45	2	4	5	172
46	2	5	1	167
47	2	5	2	185
48	2	5	3	182
49	2	5	4	197
50	2	5	5	152

Analysis of Variance Procedure

Dependent Variable: HT

Source	DF	Sum of Squares	Mean Square	F Value	Pr >
Model	1	2151.6800000	2151.6800000	6.20	0.016
Error	48	16663.4400000	347.1550000		
Corrected Total	49	18815.1200000			

R-Square	C.V.	Root MSE	HT Mea
0.114359	11.48428	18.632096	162.240000

Source	DF	Anova SS	Mean Square	F Value	Pr >
TRT	1	2151.6800000	2151.6800000	6.20	0.016

Analysis of Variance Procedure

Dependent Variable: HT

Source	DF	Sum of Squares	Mean Square	F Value	Pr >
Model	25	9709.8000000	388.3920000	1.02	0.478
Error	24	9105.3200000	379.3883333		
Corrected Total	49	18815.1200000			

R-Square	C.V.	Root MSE	HT Mea
0.516064	12.00560	19.477893	162.240000

Source	DF	Anova SS	Mean Square	F Value	Pr >
TRT	1	2151.6800000	2151.6800000	5.67	0.025
REP(PLT)	24	7558.1200000	314.9216667	0.83	0.674