

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Data Requirement: PMRA Data Code:
 EPA DP Barcode: 355006
 OECD Data Point:
 EPA Guideline: 850.4250 (123-1b)

Test material: Dimethyl disulfide **Purity:** 99.7%
 Common name
 Chemical name: IUPAC: Not reported
 CAS name: Not reported
 CAS No.: Not reported
 Synonyms: Not reported

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Date: 09/09/08

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Date: *3-28-09*

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CITATION: Porch, J.R. and Krueger, H.O. 2008. Dimethyl Disulfide: A Tier II Toxicity Test to Determine the Effects of the Test Substance on Vegetative Vigor of Ten Species of Plants. Unpublished study performed by Wildlife International, Ltd., Easton, Maryland. Laboratory Project No.: 524-104. Study sponsored and submitted by Arkema Inc., Philadelphia, Pennsylvania. Study completed July 1, 2008.

DISCLAIMER: This document provides guidance for EPA and PMRA reviewers on how to complete a data evaluation record after reviewing a scientific study concerning the acute toxicity of a pesticide to terrestrial vascular plants. It is not intended to prescribe conditions to any external party for conducting this study nor to establish absolute criteria regarding the assessment of whether the study is scientifically sound and whether the study satisfies any applicable data requirements. Reviewers are expected to review and to determine for each study, on a case-by-case basis, whether it is scientifically sound and provides sufficient information to satisfy applicable data requirements. Studies that fail to meet any of the conditions may be accepted, if appropriate; similarly, studies that meet all of the conditions may be rejected, if appropriate. In sum, the reviewer is to take into account the totality of factors related to the test methodology and results in determining the acceptability of the study.

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EXECUTIVE SUMMARY:

The effect of Dimethyl disulfide on the vegetative vigor of monocot (corn; *Zea mays*; onion, *Allium cepa*; oat, *Avena sativa*; and ryegrass, *Lolium perenne*) and dicot (cabbage, *Brassica oleracea*; soybean, *Glycine max*; sugarbeet, *Beta vulgaris*; lettuce, *Lactuca sativa*; tomato, *Lycopersicon esculentum*; and radish, *Rapahnus sativus*) crops was studied at nominal concentrations of 18.8, 37.5, 75, 150, and 300 lbs a.i./A.

The growth medium used in the seedling emergence test was a commercially obtained soil mixture, classified as a sandy loam, with an organic matter content of 1.3% and a pH of 7.2. On Day 21 the surviving plants per pot were recorded, cut, and dried for measuring the plant dry weight. Plant height was measured on days 7, 14, and 21 by measuring from the soil surface to the tip of the apical meristem or tip of the tallest leaf.

In the vegetative vigor test, the level of inhibition in dry weight across all plant treatments ranged from moderate to high, except for ryegrass and sugarbeet. Lettuce exhibited the largest inhibition of dry weight of up to 68%, and there was a very slight dose-response relationship. The level of inhibition in height across all plant treatments ranged from low to moderate, except for tomato. Tomato exhibited the largest inhibition of height of up to 61%, and there appeared to be a dose-response relationship.

In terms of survival, inhibition was non-existent in most species with the exception of oat, lettuce, and radish. Even in these few cases, inhibition was only observed at the highest treatment level.

The most sensitive monocot was oat, based on dry weight, with NOAEC and EC₂₅ values of 37.5 and 100 lbs a.i./A, respectively. The most sensitive dicot was tomato, based on height, with NOAEC and EC₂₅ values of 37.5 and 55 lbs a.i./A, respectively.

The study authors used a standard phytotoxicity rating system. There were cases of necrosis, leaf curl, adventitious growth, mortality, and chlorosis across all species and most concentrations; there were generally less effects observed at the two lowest treatment levels.

Maximum Labeled Rate: 300 lbs a.i./A

Results Synopsis

Monocot

EC ₅₀ /IC ₅₀ :	210 lbs a.i./A	95% C.I.: 180-250 lbs a.i./A
EC ₂₅ /IC ₂₅ :	100 lbs a.i./A	95% C.I.: 78-140 lbs a.i./A
EC ₀₅ /IC ₀₅ :	38 lbs a.i./A	95% C.I.: 22-65 lbs a.i./A
NOAEC:	37.5 lbs a.i./A	
Slope:	2.20	Std err: 0.299
Most sensitive monocot:	Oat	
Most sensitive parameter:	Dry weight	

Dicot

EC ₅₀ /IC ₅₀ :	150 lbs a.i./A	95% C.I.: 110-210 lbs a.i./A
EC ₂₅ /IC ₂₅ :	55 lbs a.i./A	95% C.I.: 30-99 lbs a.i./A
EC ₀₅ /IC ₀₅ :	12 lbs a.i./A	95% C.I.: 4.3-36 lbs a.i./A
NOAEC:	37.5 lbs a.i./A	
Slope:	1.51	Std err: 0.255
Most sensitive dicot:	Tomato	
Most sensitive parameter:	Height	

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This toxicity study is classified as acceptable and satisfies the guideline requirement for a Tier II terrestrial vascular plant toxicity study.

Table 1 (Tier II studies). Summary of most sensitive parameters by species (lb a.i/A).

Species	Endpoint	NOAEC	EC ₀₅	EC ₂₅	EC ₅₀
Onion	Dry weight	150	66	160	290
Oat	Dry weight	37.5	38	100	210
Ryegrass	None	300	>300	>300	>300
Corn	Dry weight	37.5	13	>300	>300
Sugarbeet	None	300	>300	>300	>300
Cabbage	Height	300	5.9	>300	>300
Soybean	Height	75	39	>300	>300
Lettuce	Dry weight	150	150	210	260
Tomato	Height	37.5	12	55	150
Radish	Dry weight	150	76	200	>300

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED:

This study was conducted following EPA Series 850 – Ecological Effects Test Guidelines OPPTS No. 850.4250. The following deviations from OPPTS 850.4100 and 850.4250 were noted:

1. The storage of the seeds was not reported.
2. The moisture (% at 1/3 atm) of the soil was not reported.
3. All species were tested under similar environmental conditions instead of separating the warm-loving species from the cold-loving species.
4. The physiochemical properties of the test material were not reported.
5. Only 5 seeds per replicate were planted; OPPTS guidelines state that 10 seeds per replicate should be planted.

COMPLIANCE:

Signed and dated No Data Confidentiality, GLP, and Quality Assurance statements were provided. A Certificate of Analysis was also provided. This study was conducted in compliance with US EPA Good Laboratory Practice Standards (40 CFR Part 160; 1989), OECD Principles of GLP (ENV/MC/CHEM (98) 17) and Japan MAFF (1999).

A. MATERIALS:

1. Test Material Dimethyl Disulfide

Description: Liquid

Lot No./Batch No. : 10.17.07 (Batch No.)

Purity: 99.7%

Stability of compound under test conditions: The study authors did not determine recovery of the test substance.

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(OECD recommends chemical stability in water and light)

Storage conditions of test chemicals:

Stored at ambient room conditions.

Table 2. Physical/chemical properties of Dimethyl Disulfide.

Parameter	Values	Comments
Water solubility at 20EC	Not reported.	
Vapor pressure	Not reported.	
UV absorption	Not reported.	
pKa	Not reported.	
Kow	Not reported.	

2. Test organism:

Monocotyledonous species: Corn (*Zea mays*; Mandan Bride), Onion (*Allium cepa*; WI 301), Oat (*Avena sativa*; Armor), and Ryegrass (*Lolium perenne*; Manhattan 4 Perennial); EPA recommends four monocots in two families, including corn.

Dicotyledonous species: Cabbage (*Brassica oleracea*; Late Flat Dutch), Soybean (*Glycine max*; Williams 82), Sugarbeet (*Beta vulgaris*; none given), Lettuce (*Lactuca sativa*; Summertime), Tomato (*Lycopersicon esculentum*; Rutgers), and Radish (*Rapahmus sativus*; Cherry Belle); (EPA recommends six dicots in four families, including soybean and a root crop.

OECD recommends a minimum of three species selected for testing, at least one from each of the following categories: Category 1: ryegrass, rice, oat, wheat, and sorghum; Category 2: mustard, rape, radish, turnip, and Chinese cabbage; Category 3: vetch, mung bean, red clover, fenugreek, lettuce, and cress.

Seed source: Wannamaker Seeds, St. Matthews, SC (onion), Wilken Seed Grains, Inc., Pontiac, IL (oat), Meyer Seed Company, Baltimore, MD (ryegrass, cabbage, tomato, and radish), Johnny's Selected Seeds, Winslow, ME (Corn), BetaSeed, Inc., Shakopee, MN (sugarbeet), Missouri Foundation Seeds, Columbia, MO (soybean), and Territorial Seed Co., Cottage Grove, OR (lettuce)

Prior seed treatment/sterilization: Seeds were not treated with fungicides, insecticides, or repellents prior to test initiation.

Historical % germination of seed: Onion, >85%; oat, 84%; ryegrass, 90%; corn, 94%; sugarbeet, 90%; cabbage, 85%; soybean, 94%; lettuce, 98%; tomato, 85%; and radish, 85%

Seed storage, if any: Not reported.

B. STUDY DESIGN:

1. Experimental Conditions

- a. Limit test: A limit test was not performed.
- b. Range-finding study: A range-finding study was not performed.

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c. Definitive Study

Table 3: Experimental Parameters - Vegetative Vigor

Parameters	Vegetative Vigor	
	Details	Remarks <i>Criteria</i>
Duration of the test	21 days	<i>Recommended test duration is 14-21 days.</i>
Number of seeds/plants replicate	There were six replicates per treatment per species tested, and each replicate consisted of five pots, with 1 seed per pot.	<i>Five plants per replicate are recommended.</i>
Number of plants retained after thinning	Thinning was not performed.	
<u>Number of replicates</u> Control: Adjuvant control: Treated:	6 N/A 6	<i>Four replicates per dose are recommended</i>
<u>Test concentrations (lbs ai/A)</u> Nominal: Measured:	0 (negative control), 18.8, 37.5, 75, 150, and 300 lbs a.i./A Not reported.	<i>Five test concentrations should be used with a dose range of 2X or 3X progression</i>
<u>Method and interval of analytical verification</u> LOQ: LOD:	Analytical verification was not performed. N/A N/A	
Adjuvant (type, percentage, if used)	N/A	
<u>Test container (pot)</u>		

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Parameters	Vegetative Vigor	
	Details	Remarks
		Criteria
Size/Volume	25 cm diameter, 19 cm depth	<i>Non-porous containers should be used.</i>
Material: (glass/polystyrene)	Plastic	<i>OECD recommends that non-porous plastic or glazed pots be used.</i>
Growth facility	Pots with planted seeds were placed in a greenhouse, and emerged seedlings selected for the study were placed in subirrigation trays on greenhouse benches.	
Method/depth of seeding	20 mm (oat, corn, and soybean) 6 mm (all other species)	
<u>Test material application</u> Application time including the plant growth stage	Test material was applied <i>ca.</i> 48 hours before the official start of the experimental period.	
Number of application	Each species was treated once	
Application interval	N/A; single application	
Method of application	Test material was applied by injection into the soil of the pots <i>ca.</i> 1 inch from the bottom. The injection pots were then transferred to sealed plastic bags that were placed outside under a shade cloth.	
<u>Details of soil used</u> Geographic location	Not applicable; soil was a mixture of commercial components.	
Depth of soil collection	N/A	

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Parameters	Vegetative Vigor	
	Details	Remarks
		Criteria
Soil texture % sand % silt % clay pH: % organic carbon CEC Moisture at 1/3 atm (%)	Sandy loam 75 11 14 7.2 1.3% Not reported. Not reported.	EPA prefers soil mixes containing sandy loam, loam, or clay loam soil with no greater than 2% organic matter. Glass beads, rock wool, and 100% acid washed sand are not preferred. OECD prefers the soil to be sieved (0.5 cm) to remove coarse fragments. Carbon content should not exceed 1.5% (3% organic matter). Fine particles (under 20um) makeup should be between 10 and 20%. The recommended pH is between 5.0 and 7.5.
Details of nutrient medium, if used	N/A	
<u>Watering regime and schedules</u> Water source/type: Volume applied: Interval of application: Method of application:	Well water/greenhouse facility. Not reported. Every 1 to 4 days. Bottom watering via subirrigation.	EPA prefers that under foliage watering or bottom watering be utilized for vegetative vigor studies so that the chemical is not washed out of the soil during the test.
Any pest control method/fertilization, if used	No pest control methods or fertilization were used.	
<u>Test conditions</u> Temperature: Photoperiod: Light intensity and quality: Relative humidity:	16.44-34.13°C 16L:8D Not reported; artificial light was used to supplement natural sunlight. 13.56-90.50%	EPA prefers that the cold vs warm loving plants be tested in two separate groups to optimize plant growth. OECD prefers that the temperature, humidity and light conditions are suitable for maintaining normal growth of each species for the test period.

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Parameters	Vegetative Vigor	
	Details	Remarks
		Criteria
Reference chemical (if used) Name: Concentrations:	N/A	
Other parameters, if any	None.	

2. Observations:

Table 4: Observation Parameters - Vegetative Vigor

Parameters	Vegetative Vigor	
	Details	Remarks
Parameters measured (i.e., plant height, dry weight or other endpoints)	Dry weight, phytotoxicity, survival, and height	
Measurement technique for each parameter	Survival, and phytotoxicity were assessed visually. Height was measured with a ruler from the surface of the soil to either the tip of the apical meristem or the tip of the tallest leaf. Dry weight was measured by clipping plants at soil level, drying the plants in an oven for 24 hours and then weighing.	
Observation intervals	Days 7, 14, and 21 for phytotoxicity and height; Day 21 only for all other endpoints	
Other observations, if any	None reported.	
Were raw data included?	Yes.	
Phytotoxicity rating system, if used	0%- No injury/effect; 10-30%- slight plant effect (effects barely noticeable to not obviously detrimental; 40-	

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	<p>60%- moderate effect involving the whole plant (recovery possible to doubtful); 70-90%- severe effect with recovery not possible (loss of some leaves to only a few surviving leaves); 100%- complete plant effect (death of plant)</p>	
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II. RESULTS and DISCUSSION:

A. INHIBITORY EFFECTS:

Vegetative Vigor:

Reviewer calculated percent survival in the negative control was 100% while treatment group survival ranged from 50% to 100% relative to the negative control. There was little inhibition in survival across all plant treatments, except for onion, sugarbeet, radish, lettuce and oat. In cases where inhibition was the highest, inhibition only occurred at the highest treatment level. Radish, lettuce, and oat had inhibitions of 10, 50, and 7%, respectively, at the 300 lbs a.i./A treatment level.

The study authors' results indicated that the level of inhibition in dry weight across all plant treatments ranged from moderate to high, except for ryegrass and sugarbeet. Lettuce exhibited the largest inhibition of dry weight of up to 68%, and there was a very slight dose-response relationship.

The study authors' results indicated that the level of inhibition in height across all plant treatments ranged from low to moderate, except for tomato. Tomato exhibited the largest inhibition of height of up to 61%, and there appeared to be a dose-response relationship.

The study author reported that based on dry weight, the most sensitive monocot was oat, with reported NOAEC and EC25 values of 37.5 and 104 lbs a.i./A. Based on the study author's data, based on height, the most sensitive dicot was tomato, with reported NOAEC and EC25 values of 37.5 and 54 lbs a.i./A.

The study authors used a standard phytotoxicity rating system. There were cases of necrosis, leaf curl, adventitious growth, mortality, and chlorosis across all species and most concentrations; there were generally less effects observed at the lowest two treatment levels.

B. REPORTED STATISTICS:

The study authors analyzed height, survival, and dry weight. The control and treatment groups were analyzed using the DUNNETT option of the GLM procedure of SAS Version 8 to determine to the NOAEC and LOAEC. Significance was determined at the level of 0.05. Estimates of EC values and their confidence limits were determined using non-linear regression analysis via the NLIN procedure of SAS Version 8.

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Table 5: Reported effect of Dimethyl Disulfide on Vegetative Vigor

Species	Results summary for dry weight (lb ai/A)									
	Weight (g)	NOAEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Onion	0.073-0.161	150	ND	N/A	157	NR	287	NR	ND	ND
Oat	0.59-1.57	37.5	ND	N/A	104	NR	211	NR	ND	ND
Ryegrass	1.09-1.18	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Corn	1.75-2.05	37.5	ND	N/A	>300	N/A	>300	N/A	ND	ND
Sugarbeet	2.28-2.52	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Cabbage	3.12-3.44	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Soybean	2.87-3.71	75	ND	N/A	>300	N/A	>300	N/A	ND	ND
Lettuce	1.03-3.16	150	ND	N/A	207	NR	259	NR	ND	ND
Tomato	1.85-5.79	75	ND	N/A	82	NR	171	NR	ND	ND
Radish	0.490-0.812	150	ND	N/A	201	NR	>300	N/A	ND	ND

ND – Not determined
NR – Not reported.

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Table 5a: Reported effect of Dimethyl Disulfide on Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	Height (cm)	NOAEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Onion	21.1-28.3	37.5	ND	N/A	>300	N/A	>300	N/A	ND	ND
Oat	49.5-62.5	37.5	ND	N/A	>300	N/A	>300	N/A	ND	ND
Ryegrass	25.9-28.7	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Corn	64.2-68.9	37.5	ND	N/A	>300	N/A	>300	N/A	ND	ND
Sugarbeet	22.8-25.2	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Cabbage	19.9-20.9	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Soybean	28.2-31.5	75	ND	N/A	>300	N/A	>300	N/A	ND	ND
Lettuce	10.4-15.7	150	ND	N/A	296	NR	>300	N/A	ND	ND
Tomato	15.4-39.6	37.5	ND	N/A	54	NR	152	NR	ND	ND
Radish	13.9-16.0	150	ND	N/A	>300	N/A	>300	N/A	ND	ND

ND – Not determined

NR – Not reported.

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Table 5b: Reported effect of Dimethyl Disulfide on Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOAEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Onion	97-100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Oat	93-100	150	ND	N/A	>300	N/A	>300	N/A	ND	ND
Ryegrass	100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Corn	100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Sugarbeet	97-100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Cabbage	100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Soybean	100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Lettuce	50-100	150	ND	N/A	273	NR	300	NR	ND	ND
Tomato	100	300	ND	N/A	>300	N/A	>300	N/A	ND	ND
Radish	90-100	150	ND	N/A	>300	N/A	>300	N/A	ND	ND

ND - Not determined

Plant Injury Index										
Control	Onion	Oat	Ryegrass	Corn	Sugarbeet	Cabbage	Soybean	Lettuce	Tomato	Radish
0-8	0-22	0-52	0-4	0-36	0-32	0-36	0-28	0-100	0-78	0-70

0%- No injury/effect; 10-30%- slight plant effect (effects barely noticeable to not obviously detrimental); 40-60%- moderate effect involving the whole plant (recovery possible to doubtful); 70-90%- severe effect with recovery not possible (loss of some leaves to only a few surviving leaves); 100%- complete plant effect (death of plant)

C. VERIFICATION OF STATISTICAL RESULTS BY THE REVIEWER:

Statistical Methods: Any species exhibiting an inhibition of $\geq 5\%$ in dry weight, height, or % survival relative to the negative control was analyzed; toxicity values for all other species and endpoints were determined visually. All analyses were conducted using the negative control. The reviewer then tested each appropriate data set for normality using the Chi-square and Shapiro-Wilks tests and for homogeneity of variance using the Hartley and Bartlett's tests. If data sets met the assumptions of ANOVA, the NOAEC values were determined using the parametric Dunnett's and Williams' tests via Toxstat statistical software. If data did not meet these assumptions, the Steel's and Kruskal-Wallis tests were used to determine the NOAEC.

The reviewer then attempted to determine the EC_x values, confidence intervals and probit slopes using the probit analysis via Nuthatch statistical software. All analyses were conducted using the nominal application rates in terms of lbs a.i./A.

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Table 6: Reviewer-calculated effects of Dimethyl Disulfide on Vegetative Vigor

Species	Results summary for dry weight (lb ai/A)									
	Weight (g)	NOAEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Onion	0.073-0.161	150	66	19-230	160	88-280	290	200-410	2.58	1.10
Oat	0.59-1.57	37.5	38	22-65	100	78-140	210	180-250	2.20	0.299
Ryegrass	1.09-1.18	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Corn	1.75-2.05	37.5	13	0.37-450	>300	N/A	>300	N/A	0.579	0.299
Sugarbeet.	2.28-2.52	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Cabbage	3.12-3.44	300	27	Not calculable	>300	N/A	>300	N/A	0.482	0.449
Soybean	2.87-3.71	75	100	37-290	>300	N/A	>300	N/A	1.89	0.863
Lettuce	1.03-3.16	150	150	85-260	210	150-280	260	220-300	6.89	2.73
Tomato	1.85-5.79	75	28	11-74	82	48-140	170	130-230	2.11	0.448
Radish	0.490-0.812	150	76	26-220	200	130-300	>300	N/A	2.30	0.898

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Table 6a: Reviewer-calculated effects of Dimethyl Disulfide on Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	Height (cm)	NOAEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Onion	21.1-28.3	150	83	19-360	>300	N/A	>300	N/A	1.49	0.796
Oat	49.5-62.5	150	170	100-260	>300	N/A	>300	N/A	3.05	1.12
Ryegrass	25.9-28.7	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Corn	64.2-68.9	37.5	65	Not calculable	>300	N/A	>300	N/A	0.356	0.288
Sugarbeet	22.8-25.2	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Cabbage	19.9-20.9	300	5.9	Not calculable	>300	N/A	>300	N/A	0.143	0.275
Soybean	28.2-31.5	75	39	Not calculable	>300	N/A	>300	N/A	0.526	0.367
Lettuce	10.4-15.7	<300	N/A	N/A	>300	N/A	>300	N/A	N/A	N/A
Tomato	15.4-39.6	37.5	12	4.3-36	55	30-99	150	110-210	1.51	0.255
Radish	13.9-16.0	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A

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Table 6b: Reviewer-calculated effects of Dimethyl Disulfide on Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOAEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Onion	97-100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Oat	93-100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Ryegrass	100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Corn	100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Sugarbeet	97-100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Cabbage	100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Soybean	100	300	>300	N/A	>300	N/A	>300	N/A	N/A	N/A
Lettuce	50-100	150	>150	N/A	>150	N/A	>150	N/A	N/A	N/A
Tomato	100	300	ND	N/A	>300	N/A	>300	N/A	N/A	N/A
Radish	90-100	150	>150	N/A	>150	N/A	>150	N/A	N/A	N/A

ND - Not determined

Plant Injury Index										
Control	Onion	Oat	Ryegrass	Corn	Sugarbeet	Cabbage	Soybean	Lettuce	Tomato	Radish
0-8	0-22	0-52	0-4	0-36	0-32	0-36	0-28	0-100	0-78	0-70

0%- No injury/effect; 10-30%- slight plant effect (effects barely noticeable to not obviously detrimental); 40-60%- moderate effect involving the whole plant (recovery possible to doubtful); 70-90%- severe effect with recovery not possible (loss of some leaves to only a few surviving leaves); 100%- complete plant effect (death of plant)

Monocot

EC₅₀/IC₅₀: 210 lbs a.i./A 95% C.I.: 180-250 lbs a.i./A
 EC₂₅/IC₂₅: 100 lbs a.i./A 95% C.I.: 78-140 lbs a.i./A
 EC₀₅/IC₀₅: 38 lbs a.i./A 95% C.I.: 22-65 lbs a.i./A
 NOAEC: 37.5 lbs a.i./A
 Slope: 2.20 Std err: 0.299
 Most sensitive monocot: Oat
 Most sensitive parameter: Dry weight

Dicot

EC₅₀/IC₅₀: 150 lbs a.i./A 95% C.I.: 110-210 lbs a.i./A
 EC₂₅/IC₂₅: 55 lbs a.i./A 95% C.I.: 30-99 lbs a.i./A
 EC₀₅/IC₀₅: 12 lbs a.i./A 95% C.I.: 4.3-36 lbs a.i./A
 NOAEC: 37.5 lbs a.i./A
 Slope: 1.51 Std err: 0.255
 Most sensitive dicot: Tomato
 Most sensitive parameter: Height

D. STUDY DEFICIENCIES:

There were no study deficiencies.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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E. REVIEWER'S COMMENTS:

Oat survival, ryegrass height, lettuce height and survival, and radish height and survival had inhibitions >5%, but lacked 3 or more distinct isotone means; therefore, the reviewer visually determined EC_x values, and reported "N/A" when necessary in the respective tables.

The study authors did not analyze for actual test concentrations, therefore only nominal test concentrations were reported.

The registrant's and the reviewer's results are in agreement; however, the reviewer was able to obtain confidence intervals and probit slopes for endpoints. The reviewer's results are presented in the Executive Summary and Conclusions sections of this DER.

The physiochemical properties of the test material were not reported.

Only 5 seeds per replicate were planted for all species; OPPTS guidelines state that 10 seeds per replicate should be planted.

The study authors performed statistics for weight on a per plant basis.

F. CONCLUSIONS:

The study is acceptable. The most sensitive monocot, based on dry weight, was oat with NOAEC and EC₂₅ values of 37.5 and 100 lbs a.i./A, respectively. The most sensitive dicot, based on height, was tomato with NOAEC and EC₂₅ values of 37.5 and 55 lbs a.i./A, respectively.

Most sensitive monocot and EC₂₅: Oat; 100 lbs a.i./A
Most sensitive dicot and EC₂₅: Tomato; 55 lbs a.i./A

III. REFERENCES:

U.S. Environmental Protection Agency. 1996. Series 850- Ecological Effects Test Guidelines (draft), OPPTS Number 850.4250: Terrestrial Plant Toxicity, Tier II (Vegetative Vigor).

Frans, Robert E. and Ronald E. Talbert. 1977. Design of Field Experiments and the Measurement and Analysis of Plant Responses. Pages 15-23 in B. Truelove, ed. Research Methods in Weed Science. Southern Weed Science Society, Auburn University, Alabama.

Bruce, Robert D. and Donald J. Versteeg. 1992. A Statistical Procedure for Modeling Continuous Toxicity Data. *Environmental Toxicology and Chemistry*. 11: 1485-1494.

SAS Institute, Inc. 1999. SAS Proprietary Software Version 8, Cary, NC, SAS Institute, Inc.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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APPENDIX I. OUTPUT OF REVIEWER'S STATISTICAL VERIFICATION:

Dimethyl disulfide & onion height (cm)
File: 1202oh Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	10	15	7	3

Calculated Chi-Square goodness of fit test statistic = 1.6100
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & onion height (cm)
File: 1202oh Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 214.442

W = 0.972

Critical W (P = 0.05) (n = 36) = 0.935
Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & onion height (cm)
File: 1202oh Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 2.53
Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & onion height (cm)

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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File: 1202oh Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 1.12
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & onion height (cm)

File: 1202oh Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	222.715	44.543	6.232
Within (Error)	30	214.442	7.148	
Total	35	437.156		

Critical F value = 2.53 (0.05,5,30)
 Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & onion height (cm)

File: 1202oh Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	27.333	27.333		
2	18.8	26.650	26.650	0.443	
3	37.5	28.300	28.300	-0.626	
4	75	23.300	23.300	2.613	*
5	150	26.133	26.133	0.777	
6	300	21.100	21.100	4.038	*

Dunnnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & onion height (cm)

File: 1202oh Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 2 OF 2 Ho:Control<Treatment

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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GROUP	IDENTIFICATION	NUM OF REPS	Minimum Sig Diff (IN ORIG. UNITS)	% of CONTROL	DIFFERENCE FROM CONTROL
1	Neg control	6			
2	18.8	6	3.597	13.2	0.683
3	37.5	6	3.597	13.2	-0.967
4	75	6	3.597	13.2	4.033
5	150	6	3.597	13.2	1.200
6	300	6	3.597	13.2	6.233

Dimethyl disulfide & onion height (cm)
File: 1202oh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	27.333	27.333	27.428
2	18.8	6	26.650	26.650	27.428
3	37.5	6	28.300	28.300	27.428
4	75	6	23.300	23.300	24.717
5	150	6	26.133	26.133	24.717
6	300	6	21.100	21.100	21.100

Dimethyl disulfide & onion height (cm)
File: 1202oh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	27.428				
18.8	27.428	0.061		1.70	k= 1, v=30
37.5	27.428	0.061		1.78	k= 2, v=30
75	24.717	1.695		1.80	k= 3, v=30
150	24.717	1.695		1.81	k= 4, v=30
300	21.100	4.038	*	1.82	k= 5, v=30

s = 2.674
Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	83.	19.	3.6E+02	0.31	0.23
EC10	1.5E+02	58.	3.7E+02	0.20	0.40
EC25	3.7E+02	2.1E+02	6.5E+02	0.12	0.57
EC50	1.1E+03	2.4E+02	4.6E+03	0.31	0.23

Slope = 1.49 Std.Err. = 0.796

!!!Poor fit: p = 0.024 based on DF= 3.0 30.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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1202OH : Dimethyl disulfide & onion height (cm)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. - Pred.	Pred. %Control	%Change
0.00	6.00	27.3	27.2	0.169	100.	0.00
18.8	6.00	26.7	27.0	-0.390	99.5	0.455
37.5	6.00	28.3	26.7	1.55	98.5	1.53
75.0	6.00	23.3	26.0	-2.68	95.7	4.34
150.	6.00	26.1	24.4	1.77	89.7	10.3
300.	6.00	21.1	21.5	-0.422	79.2	20.8

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & Oat height (cm)

File: 1202ah Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	11	13	9	2

Calculated Chi-Square goodness of fit test statistic = 1.5485

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & Oat height (cm)

File: 1202ah Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 404.048

W = 0.959

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & Oat height (cm)

File: 1202ah Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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Calculated H statistic (max Var/min Var) = 10.88
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & Oat height (cm)
 File: 1202ah Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 9.19
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & Oat height (cm)
 File: 1202ah Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	718.168	143.634	10.665
Within (Error)	30	404.048	13.468	
Total	35	1122.216		

Critical F value = 2.53 (0.05,5,30)
 Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & Oat height (cm)
 File: 1202ah Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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1	Neg control	62.333	62.333	
2	18.8	61.100	61.100	0.582
3	37.5	62.533	62.533	-0.094
4	75	59.967	59.967	1.117
5	150	59.600	59.600	1.290
6	300	49.483	49.483	6.065 *

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & Oat height (cm)
File: 1202ah Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	4.937	7.9	1.233
3	37.5	6	4.937	7.9	-0.200
4	75	6	4.937	7.9	2.367
5	150	6	4.937	7.9	2.733
6	300	6	4.937	7.9	12.850

Dimethyl disulfide & Oat height (cm)
File: 1202ah Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	62.333	62.333	62.333
2	18.8	6	61.100	61.100	61.817
3	37.5	6	62.533	62.533	61.817
4	75	6	59.967	59.967	59.967
5	150	6	59.600	59.600	59.600
6	300	6	49.483	49.483	49.483

Dimethyl disulfide & Oat height (cm)
File: 1202ah Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	62.333				
18.8	61.817	0.244		1.70	k= 1, v=30
37.5	61.817	0.244		1.78	k= 2, v=30
75	59.967	1.117		1.80	k= 3, v=30
150	59.600	1.290		1.81	k= 4, v=30
300	49.483	6.065	*	1.82	k= 5, v=30

s = 3.670

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Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	1.7E+02	1.0E+02	2.6E+02	0.099	0.63
EC10	2.2E+02	1.7E+02	2.9E+02	0.059	0.76
EC25	3.4E+02	2.9E+02	4.1E+02	0.037	0.84
EC50	5.7E+02	3.5E+02	9.5E+02	0.11	0.60

Slope = 3.05 Std.Err. = 1.12

Goodness of fit: p = 0.69 based on DF= 3.0 30.

1202AH : Dimethyl disulfide & Oat height (cm)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	62.3	61.6	0.718	100.	0.00
18.8	6.00	61.1	61.6	-0.515	100.	0.000311
37.5	6.00	62.5	61.6	0.928	100.	0.0156
75.0	6.00	60.0	61.4	-1.43	99.6	0.359
150.	6.00	59.6	59.3	0.339	96.2	3.82
300.	6.00	49.5	49.5	-0.0417	80.4	19.6

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & ryegrass height (cm)

File: 12021h Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	11	11	11	2

Calculated Chi-Square goodness of fit test statistic = 2.6495

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & ryegrass height (cm)

File: 12021h Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 85.955

W = 0.983

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Critical W (P = 0.05) (n = 36) = 0.935
 Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & ryegrass height (cm)
 File: 12021h Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 7.93
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)
 Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & ryegrass height (cm)
 File: 12021h Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 9.71
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)
 Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & ryegrass height (cm)
 File: 12021h Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	28.721	5.744	2.005
Within (Error)	30	85.955	2.865	

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Total 35 114.676

Critical F value = 2.53 (0.05,5,30)

Since F < Critical F FAIL TO REJECT Ho:All groups equal

Dimethyl disulfide & ryegrass height (cm)
File: 1202lh Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	27.367	27.367		
2	18.8	26.500	26.500	0.887	
3	37.5	27.550	27.550	-0.188	
4	75	28.733	28.733	-1.398	
5	150	25.900	25.900	1.501	
6	300	27.567	27.567	-0.205	

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & ryegrass height (cm)
File: 1202lh Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	2.277	8.3	0.867
3	37.5	6	2.277	8.3	-0.183
4	75	6	2.277	8.3	-1.367
5	150	6	2.277	8.3	1.467
6	300	6	2.277	8.3	-0.200

Dimethyl disulfide & ryegrass height (cm)
File: 1202lh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	27.367	27.367	26.933
2	18.8	6	26.500	26.500	26.933
3	37.5	6	27.550	27.550	27.394
4	75	6	28.733	28.733	27.394
5	150	6	25.900	25.900	27.394
6	300	6	27.567	27.567	27.567

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Dimethyl disulfide & ryegrass height (cm)
File: 12021h Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	26.933				
18.8	26.933	0.443		1.70	k= 1, v=30
37.5	27.394	0.028		1.78	k= 2, v=30
75	27.394	0.028		1.80	k= 3, v=30
150	27.394	0.028		1.81	k= 4, v=30
300	27.567	0.205		1.82	k= 5, v=30

s = 1.693
Note: df used for table values are approximate when v > 20.

1202LH : Dimethyl disulfide & ryegrass height (cm)

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	27.5	.		
18.8	27.5	-0.1748		N.S.
37.5	27.5	-0.1748		N.S.
75	27.5	-0.1748		N.S.
150	26.7	0.6481		N.S.
300	26.7	0.6481		N.S.

***=Significant; "N.S."=Not Significant.

!!!Failure #3: Data not suitable for probit model fit.

Criterion is 3 or more distinct isotone means.

Dimethyl disulfide & corn plant height (cm)
File: 1202zh Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	11	13	10	1

Calculated Chi-Square goodness of fit test statistic = 2.4856
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & corn plant height (cm)
File: 1202zh Transform: NO TRANSFORMATION

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PMRA Submission Number {.....}

EPA MRID Number 47471202

Shapiro Wilks test for normality

D = 557.587

W = 0.973

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & corn plant height (cm)
File: 1202zh Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 3.92
Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & corn plant height (cm)
File: 1202zh Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 3.11
Table Chi-square value = 15.09 (alpha = 0.01)
Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & corn plant height (cm)
File: 1202zh Transform: NO TRANSFORMATION

ANOVA TABLE

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

SOURCE	DF	SS	MS	F
Between	5	162.436	32.487	1.748
Within (Error)	30	557.587	18.586	
Total	35	720.022		

Critical F value = 2.53 (0.05,5,30)
 Since $F < \text{Critical } F$ FAIL TO REJECT H_0 : All groups equal

Dimethyl disulfide & corn plant height (cm)
 File: 1202zh Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	70.033	70.033		
2	18.8	67.567	67.567	0.991	
3	37.5	68.933	68.933	0.442	
4	75	64.200	64.200	2.344	*
5	150	66.067	66.067	1.594	
6	300	64.733	64.733	2.129	

Dunnnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & corn plant height (cm)
 File: 1202zh Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	5.799	8.3	2.467
3	37.5	6	5.799	8.3	1.100
4	75	6	5.799	8.3	5.833
5	150	6	5.799	8.3	3.967
6	300	6	5.799	8.3	5.300

Dimethyl disulfide & corn plant height (cm)
 File: 1202zh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	70.033	70.033	70.033
2	18.8	6	67.567	67.567	68.250
3	37.5	6	68.933	68.933	68.250

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

4	75	6	64.200	64.200	65.133
5	150	6	66.067	66.067	65.133
6	300	6	64.733	64.733	64.733

Dimethyl disulfide & corn plant height (cm)
 File: 1202zh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	70.033				
18.8	68.250	0.716		1.70	k= 1, v=30
37.5	68.250	0.716		1.78	k= 2, v=30
75	65.133	1.969	*	1.80	k= 3, v=30
150	65.133	1.969	*	1.81	k= 4, v=30
300	64.733	2.129	*	1.82	k= 5, v=30

s = 4.311

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	65.	1.8	2.3E+03	0.76	0.028
EC10	6.9E+02	29.	1.6E+04	0.68	0.042
EC25	3.5E+04	7.1	1.7E+08	1.8	0.00020
EC50	2.8E+06	0.52	1.5E+13	3.3	1.9E-07

Slope = 0.356 Std.Err. = 0.288

Goodness of fit: p = 0.45 based on DF= 3.0 30.

1202ZH : Dimethyl disulfide & corn plant height (cm)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	70.0	70.1	-0.0533	100.	0.00
18.8	6.00	67.6	67.8	-0.203	96.7	3.31
37.5	6.00	68.9	67.2	1.77	95.8	4.17
75.0	6.00	64.2	66.4	-2.23	94.8	5.22
150.	6.00	66.1	65.6	0.511	93.5	6.47
300.	6.00	64.7	64.5	0.205	92.1	7.93

!!!Warning: EC10 not bracketed by doses evaluated.

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	3	6	15	10	2

Calculated Chi-Square goodness of fit test statistic = 1.3616
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 108.507

W = 0.973

Critical W (P = 0.05) (n = 36) = 0.935
 Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 3.92
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Calculated B statistic = 2.74
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	14.973	2.995	0.828
Within (Error)	30	108.507	3.617	
Total	35	123.480		

Critical F value = 2.53 (0.05,5,30)
 Since F < Critical F FAIL TO REJECT Ho:All groups equal

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	22.100	22.100		
2	18.8	20.767	20.767	1.214	
3	37.5	20.900	20.900	1.093	
4	75	20.700	20.700	1.275	
5	150	19.933	19.933	1.973	
6	300	20.600	20.600	1.366	

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & cabbage height (cm)
 File: 1202ch Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	2.558	11.6	1.333

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....} EPA MRID Number 47471202

3	37.5	6	2.558	11.6	1.200
4	75	6	2.558	11.6	1.400
5	150	6	2.558	11.6	2.167
6	300	6	2.558	11.6	1.500

Dimethyl disulfide & cabbage height (cm)
File: 1202ch Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	22.100	22.100	22.100
2	18.8	6	20.767	20.767	20.833
3	37.5	6	20.900	20.900	20.833
4	75	6	20.700	20.700	20.700
5	150	6	19.933	19.933	20.267
6	300	6	20.600	20.600	20.267

Dimethyl disulfide & cabbage height (cm)
File: 1202ch Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	22.100				
18.8	20.833	1.154		1.70	k= 1, v=30
37.5	20.833	1.154		1.78	k= 2, v=30
75	20.700	1.275		1.80	k= 3, v=30
150	20.267	1.670		1.81	k= 4, v=30
300	20.267	1.670		1.82	k= 5, v=30

s = 1.902

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	5.9	1.8E-06	2.0E+07	3.2	3.0E-07
EC10	2.0E+03	0.0025	1.7E+09	2.9	1.2E-06
EC25	3.6E+07	1.1E-14	1.1E+29	11.	3.2E-22
EC50	1.9E+12	3.1E-28	1.1E+52	20.	1.7E-40

Slope = 0.143 Std.Err. = 0.275

Goodness of fit: p = 0.87 based on DF= 3.0 30.

1202CH : Dimethyl disulfide & cabbage height (cm)

Observed vs. Predicted Treatment Group Means

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....} **EPA MRID Number 47471202**

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	22.1	22.1	-0.00201	100.	0.00
18.8	6.00	20.8	20.8	-0.0562	94.2	5.79
37.5	6.00	20.9	20.7	0.191	93.7	6.30
75.0	6.00	20.7	20.6	0.112	93.1	6.85
150.	6.00	19.9	20.5	-0.525	92.6	7.44
300.	6.00	20.6	20.3	0.280	91.9	8.06

!!!Warning: EC5 not bracketed by doses evaluated.

!!!Warning: EC10 not bracketed by doses evaluated.

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & soybean height (cm)
File: 1202sh Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	2	8	18	4	4

Calculated Chi-Square goodness of fit test statistic = 5.0348
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & soybean height (cm)
File: 1202sh Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 240.367

W = 0.931

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & soybean height (cm)
File: 1202sh Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 6.99

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & soybean height (cm)
 File: 1202sh Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 6.41
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & soybean height (cm)
 File: 1202sh Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	71.112	14.222	1.775
Within (Error)	30	240.367	8.012	
Total	35	311.479		

Critical F value = 2.53 (0.05,5,30)
 Since F < Critical F FAIL TO REJECT Ho:All groups equal

Dimethyl disulfide & soybean height (cm)
 File: 1202sh Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

1	Neg control	32.367	32.367	
2	18.8	31.233	31.233	0.694
3	37.5	31.467	31.467	0.551
4	75	30.533	30.533	1.122
5	150	28.200	28.200	2.550 *
6	300	29.233	29.233	1.917

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & soybean height (cm)
File: 1202sh Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	3.808	11.8	1.133
3	37.5	6	3.808	11.8	0.900
4	75	6	3.808	11.8	1.833
5	150	6	3.808	11.8	4.167
6	300	6	3.808	11.8	3.133

Dimethyl disulfide & soybean height (cm)
File: 1202sh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	32.367	32.367	32.367
2	18.8	6	31.233	31.233	31.350
3	37.5	6	31.467	31.467	31.350
4	75	6	30.533	30.533	30.533
5	150	6	28.200	28.200	28.717
6	300	6	29.233	29.233	28.717

Dimethyl disulfide & soybean height (cm)
File: 1202sh Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	32.367				
18.8	31.350	0.622		1.70	k= 1, v=30
37.5	31.350	0.622		1.78	k= 2, v=30
75	30.533	1.122		1.80	k= 3, v=30
150	28.717	2.233	*	1.81	k= 4, v=30
300	28.717	2.233	*	1.82	k= 5, v=30

s = 2.831

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Note: df used for table values are approximate when $v > 20$.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	39.	1.2	1.3E+03	0.74	0.031
EC10	1.9E+02	26.	1.4E+03	0.42	0.14
EC25	2.8E+03	71.	1.1E+05	0.78	0.026
EC50	5.3E+04	27.	1.0E+08	1.6	0.00052

Slope = 0.526 Std.Err. = 0.367

Goodness of fit: $p = 0.58$ based on $DF = 3.0$ 30.

1202SH : Dimethyl disulfide & soybean height (cm)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	32.4	32.5	-0.0866	100.	0.00
18.8	6.00	31.2	31.3	-0.0870	96.5	3.49
37.5	6.00	31.5	30.9	0.601	95.1	4.89
75.0	6.00	30.5	30.3	0.260	93.3	6.72
150.	6.00	28.2	29.5	-1.32	91.0	9.03
300.	6.00	29.2	28.6	0.637	88.1	11.9

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & lettuce height (cm)

File: 1202gh Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.345	8.470	13.370	8.470	2.345
OBSERVED	0	12	11	12	0

Calculated Chi-Square goodness of fit test statistic = 8.0525

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & lettuce height (cm)

File: 1202gh Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 153.752

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

W = 0.914

Critical W (P = 0.05) (n = 35) = 0.934

Critical W (P = 0.01) (n = 35) = 0.910

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & lettuce height (cm)
 File: 1202gh Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 42.36
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 4.83
 (average df used)

Data FAIL homogeneity test. Try another transformation.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & lettuce height (cm)
 File: 1202gh Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 28.32
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 4.83
 Used for Chi-square table value ==> df (#groups-1) = 5

Data FAIL homogeneity test at 0.01 level. Try another transformation.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & lettuce height (cm)
 File: 1202gh Transform: NO TRANSFORMATION

KRUSKAL-WALLIS ANOVA BY RANKS - TABLE 1 OF 2

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	RANK SUM
1	Neg control	14.500	14.500	109.500

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}	EPA MRID Number 47471202			
2	18.8	13.833	13.833	78.000
3	37.5	14.500	14.500	107.000
4	75	14.733	14.733	119.500
5	150	15.667	15.667	164.000
6	300	10.360	10.360	52.000

Calculated H Value = 9.305 Critical H Value Table = 11.070
 Since Calc H < Crit H FAIL TO REJECT Ho: All groups are equal.

Dimethyl disulfide & lettuce height (cm)
 File: 1202gh Transform: NO TRANSFORMATION

DUNNS MULTIPLE COMPARISON - KRUSKAL-WALLIS - TABLE 2 OF 2

GROUP	IDENTIFICATION	TRANSFORMED MEAN	ORIGINAL MEAN	GROUP						
				0	0	0	0	0	0	
6	300	10.360	10.360	\						
2	18.8	13.833	13.833	. \						
3	37.5	14.500	14.500	. . \						
1	Neg control	14.500	14.500	. . . \						
4	75	14.733	14.733 \						
5	150	15.667	15.667 \						

* = significant difference (p=0.05) . = no significant difference
 Table q value (0.05,6) = 2.936 Unequal reps - multiple SE values

1202GH : Dimethyl disulfide & lettuce height (cm)

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	14.6	.		
18.8	14.6	-0.1103	N.S.	
37.5	14.6	-0.1103	N.S.	
75	14.6	-0.1103	N.S.	
150	14.6	-0.1103	N.S.	
300	10.4	2.969	<0.005	*

***=Significant; "N.S."=Not Significant.

!!!Failure #3: Data not suitable for probit model fit.

Criterion is 3 or more distinct isotone means.

Dimethyl disulfide & Tomato height (cm)
 File: 1202th Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	12	11	10	2

Calculated Chi-Square goodness of fit test statistic = 2.8790
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 507.487

W = 0.982

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 12.26
Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 9.13
Table Chi-square value = 15.09 (alpha = 0.01)
Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	3738.703	747.741	44.203
Within (Error)	30	507.487	16.916	
Total	35	4246.190		

Critical F value = 2.53 (0.05,5,30)
Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	40.067	40.067		
2	18.8	39.633	39.633	0.182	
3	37.5	38.500	38.500	0.660	
4	75	25.733	25.733	6.036	*
5	150	18.733	18.733	8.984	*
6	300	15.433	15.433	10.374	*

Dunnnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	5.533	13.8	0.433
3	37.5	6	5.533	13.8	1.567
4	75	6	5.533	13.8	14.333
5	150	6	5.533	13.8	21.333
6	300	6	5.533	13.8	24.633

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	40.067	40.067	40.067
2	18.8	6	39.633	39.633	39.633
3	37.5	6	38.500	38.500	38.500
4	75	6	25.733	25.733	25.733
5	150	6	18.733	18.733	18.733
6	300	6	15.433	15.433	15.433

Dimethyl disulfide & Tomato height (cm)
File: 1202th Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	40.067				
18.8	39.633	0.182		1.70	k= 1, v=30
37.5	38.500	0.660		1.78	k= 2, v=30
75	25.733	6.036	*	1.80	k= 3, v=30
150	18.733	8.984	*	1.81	k= 4, v=30
300	15.433	10.374	*	1.82	k= 5, v=30

s = 4.113

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	12.	4.3	36.	0.23	0.34
EC10	22.	8.9	52.	0.19	0.41
EC25	55.	30.	99.	0.13	0.55
EC50	1.5E+02	1.1E+02	2.1E+02	0.072	0.71

Slope = 1.51 Std.Err. = 0.255

!!!Poor fit: p = 0.044 based on DF= 3.0 30.

1202TH : Dimethyl disulfide & Tomato height (cm)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	40.1	41.9	-1.86	100.	0.00
18.8	6.00	39.6	38.4	1.27	91.5	8.49

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}					EPA MRID Number 47471202	
37.5	6.00	38.5	34.4	4.07	82.1	17.9
75.0	6.00	25.7	28.5	-2.74	67.9	32.1
150.	6.00	18.7	21.1	-2.41	50.4	49.6
300.	6.00	15.4	13.8	1.66	32.8	67.2

!!!Warning: EC5 not bracketed by doses evaluated.

Dimethyl disulfide & Radish height (cm)
 File: 1202rh Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	2	7	16	9	2

Calculated Chi-Square goodness of fit test statistic = 0.8542
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & Radish height (cm)
 File: 1202rh Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 1003802.335

W = 0.383

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & Radish height (cm)
 File: 1202rh Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 437685.30
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data FAIL homogeneity test. Try another transformation.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & Radish height (cm)
File: 1202rh Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 224.52
Table Chi-square value = 15.09 (alpha = 0.01)
Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
Used for Chi-square table value ==> df (#groups-1) = 5

Data FAIL homogeneity test at 0.01 level. Try another transformation.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & Radish height (cm)
File: 1202rh Transform: NO TRANSFORMATION

STEELS MANY-ONE RANK TEST			Ho:Control<Treatment			
GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Neg control	15.733				
2	18.8	15.967	42.00	25.00	6.00	
3	37.5	16.033	42.00	25.00	6.00	
4	75	15.533	38.00	25.00	6.00	
5	150	15.033	32.50	25.00	6.00	
6	300	197.217	31.00	25.00	6.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

1202RH : Dimethyl disulfide & Radish height (cm)

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	45.9	.		
18.8	45.9	-0.2858		N.S.
37.5	45.9	-0.2858		N.S.
75	45.9	-0.2858		N.S.
150	45.9	-0.2858		N.S.
300	45.9	-0.2858		N.S.

***=Significant; "N.S."=Not Significant.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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!!!Failure #3: Data not suitable for probit model fit.

Criterion is 3 or more distinct isotone means.

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	0	13	15	3	5

Calculated Chi-Square goodness of fit test statistic = 11.1577
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 0.047

W = 0.902

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 7.11
Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 4.39
Table Chi-square value = 15.09 (alpha = 0.01)
Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.031	0.006	3.000
Within (Error)	30	0.047	0.002	
Total	35	0.079		

Critical F value = 2.53 (0.05,5,30)
Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	0.140	0.140		
2	18.8	0.162	0.162	-0.826	
3	37.5	0.154	0.154	-0.549	
4	75	0.139	0.139	0.026	
5	150	0.117	0.117	0.904	
6	300	0.073	0.073	2.601	*

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	0.060	42.9	-0.021
3	37.5	6	0.060	42.9	-0.014
4	75	6	0.060	42.9	0.001
5	150	6	0.060	42.9	0.023
6	300	6	0.060	42.9	0.067

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	0.140	0.140	0.152
2	18.8	6	0.162	0.162	0.152
3	37.5	6	0.154	0.154	0.152
4	75	6	0.139	0.139	0.139
5	150	6	0.117	0.117	0.117
6	300	6	0.073	0.073	0.073

Dimethyl disulfide & Onion Dry Weight (g)
File: 1202ow Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	0.152				
18.8	0.152	0.516		1.70	k= 1, v=30
37.5	0.152	0.516		1.78	k= 2, v=30
75	0.139	0.029		1.80	k= 3, v=30
150	0.117	1.017		1.81	k= 4, v=30
300	0.073	2.927	*	1.82	k= 5, v=30

s = 0.040
Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds	Std.Err.	Lower Bound
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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		Lower	Upper		/Estimate
EC5	66.	19.	2.3E+02	0.27	0.28
EC10	91.	34.	2.5E+02	0.21	0.37
EC25	1.6E+02	88.	2.8E+02	0.12	0.56
EC50	2.9E+02	2.0E+02	4.1E+02	0.075	0.71

Slope = 2.58 Std.Err. = 1.10

Goodness of fit: p = 0.83 based on DF= 3.0 30.

 1202OW : Dimethyl disulfide & Onion Dry Weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. - Pred.	Pred. %Control	%Change
0.00	6.00	0.140	0.152	-0.0118	100.	0.00
18.8	6.00	0.161	0.152	0.00971	99.9	0.113
37.5	6.00	0.154	0.150	0.00408	98.9	1.13
75.0	6.00	0.140	0.142	-0.00239	93.4	6.63
150.	6.00	0.117	0.116	0.000365	76.6	23.4
300.	6.00	0.0730	0.0730	2.96e-05	48.0	52.0

Dimethyl disulfide & oat dry weight (g)
 File: 1202aw Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	11	11	11	2

 Calculated Chi-Square goodness of fit test statistic = 2.6495
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & oat dry weight (g)
 File: 1202aw Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 0.518

W = 0.984

Critical W (P = 0.05) (n = 36) = 0.935
 Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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Dimethyl disulfide & oat dry weight (g)
 File: 1202aw Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 11.09
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & oat dry weight (g)
 File: 1202aw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 9.01
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & oat dry weight (g)
 File: 1202aw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	4.760	0.952	56.000
Within (Error)	30	0.518	0.017	
Total	35	5.278		

Critical F value = 2.53 (0.05,5,30)
 Since F > Critical F REJECT Ho: All groups equal

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Dimethyl disulfide & oat dry weight (g)
File: 1202aw Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	1.580	1.580		
2	18.8	1.502	1.502	1.041	
3	37.5	1.567	1.567	0.177	
4	75	1.308	1.308	3.609	*
5	150	0.972	0.972	8.081	*
6	300	0.587	0.587	13.196	*

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & oat dry weight (g)
File: 1202aw Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	0.175	11.1	0.078
3	37.5	6	0.175	11.1	0.013
4	75	6	0.175	11.1	0.272
5	150	6	0.175	11.1	0.608
6	300	6	0.175	11.1	0.993

Dimethyl disulfide & oat dry weight (g)
File: 1202aw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	1.580	1.580	1.580
2	18.8	6	1.502	1.502	1.534
3	37.5	6	1.567	1.567	1.534
4	75	6	1.308	1.308	1.308
5	150	6	0.972	0.972	0.972
6	300	6	0.587	0.587	0.587

Dimethyl disulfide & oat dry weight (g)
File: 1202aw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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Neg control	1.580				
18.8	1.534	0.604		1.70	k= 1, v=30
37.5	1.534	0.604		1.78	k= 2, v=30
75	1.308	3.581	*	1.80	k= 3, v=30
150	0.972	8.018	*	1.81	k= 4, v=30
300	0.587	13.092	*	1.82	k= 5, v=30

s = 0.131

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	38.	22.	65.	0.12	0.58
EC10	55.	35.	86.	0.096	0.64
EC25	1.0E+02	78.	1.4E+02	0.061	0.75
EC50	2.1E+02	1.8E+02	2.5E+02	0.033	0.86

Slope = 2.20 Std.Err. = 0.299

Goodness of fit: p = 0.64 based on DF= 3.0 30.

1202AW : Dimethyl disulfide & oat dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	1.58	1.57	0.00606	100.	0.00
18.8	6.00	1.50	1.56	-0.0558	99.0	1.04
37.5	6.00	1.57	1.50	0.0705	95.1	4.94
75.0	6.00	1.31	1.32	-0.0114	83.8	16.2
150.	6.00	0.972	0.988	-0.0164	62.8	37.2
300.	6.00	0.587	0.580	0.00700	36.8	63.2

Dimethyl disulfide & corn dry weight (g)

File: 1202zw Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	2	8	16	8	2

Calculated Chi-Square goodness of fit test statistic = 0.6246

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & corn dry weight (g)

File: 1202zw Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

D = 1.684

W = 0.973

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & corn dry weight (g)

File: 1202zw Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 4.53

Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5

Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & corn dry weight (g)

File: 1202zw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 3.18

Table Chi-square value = 15.09 (alpha = 0.01)

Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00

Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & corn dry weight (g)

File: 1202zw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....} EPA MRID Number 47471202

Between	5	0.759	0.152	2.714
Within (Error)	30	1.684	0.056	
Total	35	2.444		

Critical F value = 2.53 (0.05,5,30)
 Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & corn dry weight (g)
 File: 1202zw Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	2.158	2.158		
2	18.8	2.037	2.037	0.891	
3	37.5	2.048	2.048	0.805	
4	75	1.822	1.822	2.464	*
5	150	1.855	1.855	2.220	
6	300	1.748	1.748	3.001	*

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & corn dry weight (g)
 File: 1202zw Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	0.318	14.7	0.122
3	37.5	6	0.318	14.7	0.110
4	75	6	0.318	14.7	0.337
5	150	6	0.318	14.7	0.303
6	300	6	0.318	14.7	0.410

Dimethyl disulfide & corn dry weight (g)
 File: 1202zw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	2.158	2.158	2.158
2	18.8	6	2.037	2.037	2.043
3	37.5	6	2.048	2.048	2.043
4	75	6	1.822	1.822	1.838
5	150	6	1.855	1.855	1.838
6	300	6	1.748	1.748	1.748

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Dimethyl disulfide & corn dry weight (g)
 File: 1202zw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	2.158				
18.8	2.043	0.847		1.70	k= 1, v=30
37.5	2.043	0.847		1.78	k= 2, v=30
75	1.838	2.339	*	1.80	k= 3, v=30
150	1.838	2.339	*	1.81	k= 4, v=30
300	1.748	2.997	*	1.82	k= 5, v=30

s = 0.237

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	13.	0.37	4.5E+02	0.76	0.029
EC10	55.	5.7	5.2E+02	0.48	0.10
EC25	6.1E+02	1.2E+02	3.2E+03	0.35	0.19
EC50	9.0E+03	1.8E+02	4.4E+05	0.83	0.020

Slope = 0.579 Std.Err. = 0.299

Goodness of fit: p = 0.68 based on DF= 3.0 30.

1202ZW : Dimethyl disulfide & corn dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	2.16	2.16	-0.00579	100.	0.00
18.8	6.00	2.04	2.03	0.00368	93.9	6.06
37.5	6.00	2.05	1.98	0.0668	91.6	8.44
75.0	6.00	1.82	1.92	-0.0943	88.5	11.5
150.	6.00	1.86	1.84	0.0198	84.8	15.2
300.	6.00	1.75	1.74	0.00977	80.3	19.7

!!!Warning: EC5 not bracketed by doses evaluated.

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL <-1.5 -1.5 to <-0.5 -0.5 to 0.5 >0.5 to 1.5 >1.5

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	3	9	12	11	1

 Calculated Chi-Square goodness of fit test statistic = 1.8036
 Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

 D = 6.069

W = 0.955

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

 Data PASS normality test at P=0.01 level. Continue analysis.

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

 Calculated H statistic (max Var/min Var) = 3.10
 Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
 Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

 Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

 Calculated B statistic = 1.72
 Table Chi-square value = 15.09 (alpha = 0.01)
 Table Chi-square value = 11.07 (alpha = 0.05)

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Average df used in calculation ==> df (avg n - 1) = 5.00
 Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.859	0.172	0.851
Within (Error)	30	6.069	0.202	
Total	35	6.928		

Critical F value = 2.53 (0.05,5,30)
 Since F < Critical F FAIL TO REJECT Ho:All groups equal

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	3.588	3.588		
2	18.8	3.332	3.332	0.989	
3	37.5	3.438	3.438	0.578	
4	75	3.360	3.360	0.880	
5	150	3.193	3.193	1.522	
6	300	3.117	3.117	1.818	

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & cabbage dry weight (g)
 File: 1202cw Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	0.605	16.8	0.257
3	37.5	6	0.605	16.8	0.150
4	75	6	0.605	16.8	0.228
5	150	6	0.605	16.8	0.395
6	300	6	0.605	16.8	0.472

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Dimethyl disulfide & cabbage dry weight (g)
File: 1202cw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	3.588	3.588	3.588
2	18.8	6	3.332	3.332	3.385
3	37.5	6	3.438	3.438	3.385
4	75	6	3.360	3.360	3.360
5	150	6	3.193	3.193	3.193
6	300	6	3.117	3.117	3.117

Dimethyl disulfide & cabbage dry weight (g)
File: 1202cw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	3.588				
18.8	3.385	0.783		1.70	k= 1, v=30
37.5	3.385	0.783		1.78	k= 2, v=30
75	3.360	0.879		1.80	k= 3, v=30
150	3.193	1.521		1.81	k= 4, v=30
300	3.117	1.816		1.82	k= 5, v=30

s = 0.450

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	27.	0.14	5.2E+03	1.1	0.0053
EC10	1.5E+02	7.8	3.1E+03	0.64	0.050
EC25	2.8E+03	17.	4.7E+05	1.1	0.0060
EC50	7.0E+04	1.5	3.4E+09	2.3	2.1E-05

Slope = 0.482 Std.Err. = 0.449

Goodness of fit: p = 0.92 based on DF= 3.0 30.

1202CW : Dimethyl disulfide & cabbage dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	3.59	3.58	0.0109	100.	0.00

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}	EPA MRID Number 47471202					
18.8	6.00	3.33	3.43	-0.0937	95.7	4.25
37.5	6.00	3.44	3.37	0.0660	94.3	5.73
75.0	6.00	3.36	3.31	0.0544	92.4	7.60
150.	6.00	3.19	3.22	-0.0301	90.1	9.90
300.	6.00	3.12	3.12	-0.00770	87.3	12.7

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	27.	0.14	5.2E+03	1.1	0.0053
EC10	1.5E+02	7.8	3.1E+03	0.64	0.050
EC25	2.8E+03	17.	4.7E+05	1.1	0.0060
EC50	7.0E+04	1.5	3.4E+09	2.3	2.1E-05

Slope = 0.482 Std.Err. = 0.449

Goodness of fit: p = 0.92 based on DF= 3.0 30.

1202CW : Dimethyl disulfide & cabbage dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	3.59	3.58	0.0109	100.	0.00
18.8	6.00	3.33	3.43	-0.0937	95.7	4.25
37.5	6.00	3.44	3.37	0.0660	94.3	5.73
75.0	6.00	3.36	3.31	0.0544	92.4	7.60
150.	6.00	3.19	3.22	-0.0301	90.1	9.90
300.	6.00	3.12	3.12	-0.00770	87.3	12.7

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & soybean dry weight (g)
File: 1202sw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	3.439	0.688	5.212
Within (Error)	30	3.945	0.132	
Total	35	7.385		

Critical F value = 2.53 (0.05,5,30)

Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & soybean dry weight (g)

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

File: 1202sw Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	3.785	3.785		
2	18.8	3.500	3.500	1.359	
3	37.5	3.548	3.548	1.128	
4	75	3.705	3.705	0.381	
5	150	3.245	3.245	2.574	*
6	300	2.865	2.865	4.386	*

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & soybean dry weight (g)
File: 1202sw Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	0.489	12.9	0.285
3	37.5	6	0.489	12.9	0.237
4	75	6	0.489	12.9	0.080
5	150	6	0.489	12.9	0.540
6	300	6	0.489	12.9	0.920

Dimethyl disulfide & soybean dry weight (g)
File: 1202sw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	3.785	3.785	3.785
2	18.8	6	3.500	3.500	3.584
3	37.5	6	3.548	3.548	3.584
4	75	6	3.705	3.705	3.584
5	150	6	3.245	3.245	3.245
6	300	6	2.865	2.865	2.865

Dimethyl disulfide & soybean dry weight (g)
File: 1202sw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	3.785				

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

18.8	3.584	0.958		1.70	k= 1, v=30
37.5	3.584	0.958		1.78	k= 2, v=30
75	3.584	0.958		1.80	k= 3, v=30
150	3.245	2.579	*	1.81	k= 4, v=30
300	2.865	4.394	*	1.82	k= 5, v=30

s = 0.363

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	1.0E+02	37.	2.9E+02	0.22	0.36
EC10	1.6E+02	84.	3.1E+02	0.14	0.52
EC25	3.4E+02	2.3E+02	4.9E+02	0.079	0.69
EC50	7.7E+02	2.9E+02	2.0E+03	0.21	0.38

Slope = 1.89 Std.Err. = 0.863

Goodness of fit: p = 0.36 based on DF= 3.0 30.

1202SW : Dimethyl disulfide & soybean dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	3.78	3.65	0.134	100.	0.00
18.8	6.00	3.50	3.65	-0.147	99.9	0.117
37.5	6.00	3.55	3.63	-0.0790	99.3	0.661
75.0	6.00	3.71	3.55	0.156	97.2	2.81
150.	6.00	3.24	3.32	-0.0785	91.0	8.98
300.	6.00	2.87	2.85	0.0150	78.1	21.9

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	1.0E+02	37.	2.9E+02	0.22	0.36
EC10	1.6E+02	84.	3.1E+02	0.14	0.52
EC25	3.4E+02	2.3E+02	4.9E+02	0.079	0.69
EC50	7.7E+02	2.9E+02	2.0E+03	0.21	0.38

Slope = 1.89 Std.Err. = 0.863

Goodness of fit: p = 0.36 based on DF= 3.0 30.

1202SW : Dimethyl disulfide & soybean dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

0.00	6.00	3.78	3.65	0.134	100.	0.00
18.8	6.00	3.50	3.65	-0.147	99.9	0.117
37.5	6.00	3.55	3.63	-0.0790	99.3	0.661
75.0	6.00	3.71	3.55	0.156	97.2	2.81
150.	6.00	3.24	3.32	-0.0785	91.0	8.98
300.	6.00	2.87	2.85	0.0150	78.1	21.9

!!!Warning: EC25 not bracketed by doses evaluated.

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & Lettuce dry weight (g)
File: 1202gw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	18.496	3.699	16.968
Within (Error)	29	6.313	0.218	
Total	34	24.808		

Critical F value = 2.55 (0.05,5,29)
Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & Lettuce dry weight (g)
File: 1202gw 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	Neg control	3.173	3.173		
2	18.8	3.022	3.022	0.563	
3	37.5	3.158	3.158	0.056	
4	75	3.157	3.157	0.062	
5	150	2.967	2.967	0.767	
6	300	1.030	1.030	7.581	*

Bonferroni T table value = 2.46 (1 Tailed Value, P=0.05, df=29,5)

Dimethyl disulfide & Lettuce dry weight (g)
File: 1202gw 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	Neg control	6			
2	18.8	6	0.664	20.9	0.152
3	37.5	6	0.664	20.9	0.015
4	75	6	0.664	20.9	0.017

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}	EPA MRID Number 47471202				
5	150	6	0.664	20.9	0.207
6	300	5	0.696	21.9	2.143

Dimethyl disulfide & Lettuce dry weight (g)
 File: 1202gw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	3.173	3.173	3.173
2	18.8	6	3.022	3.022	3.112
3	37.5	6	3.158	3.158	3.112
4	75	6	3.157	3.157	3.112
5	150	6	2.967	2.967	2.967
6	300	5	1.030	1.030	1.030

Dimethyl disulfide & Lettuce dry weight (g)
 File: 1202gw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	3.173				
18.8	3.112	0.227		1.70	k= 1, v=29
37.5	3.112	0.227		1.78	k= 2, v=29
75	3.112	0.227		1.81	k= 3, v=29
150	2.967	0.767		1.82	k= 4, v=29
300	1.030	7.587	*	1.83	k= 5, v=29

s = 0.467
 Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	1.5E+02	85.	2.6E+02	0.12	0.57
EC10	1.7E+02	1.1E+02	2.7E+02	0.10	0.63
EC25	2.1E+02	1.5E+02	2.8E+02	0.066	0.73
EC50	2.6E+02	2.2E+02	3.0E+02	0.032	0.86

Slope = 6.89 Std.Err. = 2.73

Goodness of fit: p = 0.97 based on DF= 3.0 29.

1202GW : Dimethyl disulfide & Lettuce dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

0.00	6.00	3.17	3.13	0.0458	100.	0.00
18.8	6.00	3.02	3.13	-0.106	100.	2.27e-13
37.5	6.00	3.16	3.13	0.0308	100.	3.76e-07
75.0	6.00	3.16	3.13	0.0295	100.	0.0106
150.	6.00	2.97	2.97	-0.000221	94.9	5.14
300.	5.00	1.03	1.03	1.34e-05	32.9	67.1

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	11	13	8	3

Calculated Chi-Square goodness of fit test statistic = 1.6701
Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 20.631

W = 0.886

Critical W (P = 0.05) (n = 36) = 0.935
Critical W (P = 0.01) (n = 36) = 0.912

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 15.07
Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)

Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 9.86
Table Chi-square value = 15.09 (alpha = 0.01)
Table Chi-square value = 11.07 (alpha = 0.05)

Average df used in calculation ==> df (avg n - 1) = 5.00
Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	77.771	15.554	22.608
Within (Error)	30	20.631	0.688	
Total	35	98.403		

Critical F value = 2.53 (0.05,5,30)
Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

DUNNETT'S TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	5.085	5.085		
2	18.8	5.790	5.790	-1.472	
3	37.5	5.577	5.577	-1.028	
4	75	4.306	4.306	1.627	
5	150	2.709	2.709	4.961	*
6	300	1.850	1.850	6.755	*

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	1.116	21.9	-0.705
3	37.5	6	1.116	21.9	-0.492
4	75	6	1.116	21.9	0.779
5	150	6	1.116	21.9	2.376
6	300	6	1.116	21.9	3.235

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	5.085	5.085	5.484
2	18.8	6	5.790	5.790	5.484
3	37.5	6	5.577	5.577	5.484
4	75	6	4.306	4.306	4.306
5	150	6	2.709	2.709	2.709
6	300	6	1.850	1.850	1.850

Dimethyl disulfide & Tomato dry weight (g)
File: 1202tw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	5.484				
18.8	5.484	0.834		1.70	k= 1, v=30
37.5	5.484	0.834		1.78	k= 2, v=30
75	4.306	1.627		1.80	k= 3, v=30
150	2.709	4.962	*	1.81	k= 4, v=30
300	1.850	6.757	*	1.82	k= 5, v=30

s = 0.829

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds	Std.Err.	Lower Bound
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Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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		Lower	Upper		/Estimate
EC5	28.	11.	74.	0.21	0.38
EC10	42.	19.	94.	0.17	0.45
EC25	82.	48.	1.4E+02	0.11	0.58
EC50	1.7E+02	1.3E+02	2.3E+02	0.064	0.74

Slope = 2.11 Std.Err. = 0.448

Goodness of fit: p = 0.25 based on DF= 3.0 30.

1202TW : Dimethyl disulfide & Tomato dry weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. - Pred.	%Control	%Change
0.00	6.00	5.08	5.60	-0.517	100.	0.00
18.8	6.00	5.79	5.48	0.309	97.8	2.16
37.5	6.00	5.58	5.14	0.437	91.8	8.25
75.0	6.00	4.31	4.34	-0.0317	77.4	22.6
150.	6.00	2.71	3.06	-0.354	54.7	45.3
300.	6.00	1.85	1.69	0.156	30.2	69.8

Dimethyl disulfide & radish weight (g)

File: 1202rw Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	0	12	14	6	4

Calculated Chi-Square goodness of fit test statistic = 5.5471

Table Chi-Square value (alpha = 0.01) = 13.277

Data PASS normality test. Continue analysis.

Dimethyl disulfide & radish weight (g)

File: 1202rw Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 0.534

W = 0.953

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data PASS normality test at P=0.01 level. Continue analysis.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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Dimethyl disulfide & radish weight (g)
File: 1202rw Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Calculated H statistic (max Var/min Var) = 3.57
Closest, conservative, Table H statistic = 38.0 (alpha = 0.01)
Used for Table H ==> R (# groups) = 6, df (# reps-1) = 5
Actual values ==> R (# groups) = 6, df (# avg reps-1) = 5.00

Data PASS homogeneity test. Continue analysis.

NOTE: This test requires equal replicate sizes. If they are unequal but do not differ greatly, the Hartley test may still be used as an approximate test (average df are used).

Dimethyl disulfide & radish weight (g)
File: 1202rw Transform: NO TRANSFORMATION

Bartlett's test for homogeneity of variance

Calculated B statistic = 2.74
Table Chi-square value = 15.09 (alpha = 0.01)
Table Chi-square value = 11.07 (alpha = 0.05)
Average df used in calculation ==> df (avg n - 1) = 5.00
Used for Chi-square table value ==> df (#groups-1) = 5

Data PASS homogeneity test at 0.01 level. Continue analysis.

NOTE: If groups have unequal replicate sizes the average replicate size is used to calculate the B statistic (see above).

Dimethyl disulfide & radish weight (g)
File: 1202rw Transform: NO TRANSFORMATION

ANOVA TABLE

SOURCE	DF	SS	MS	F
Between	5	0.472	0.094	5.222
Within (Error)	30	0.534	0.018	
Total	35	1.005		

Critical F value = 2.53 (0.05,5,30)
Since F > Critical F REJECT Ho:All groups equal

Dimethyl disulfide & radish weight (g)

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

File: 1202rw Transform: NO TRANSFORMATION

DUNNETTS TEST - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG
1	Neg control	0.774	0.774		
2	18.8	0.809	0.809	-0.456	
3	37.5	0.812	0.812	-0.495	
4	75	0.771	0.771	0.034	
5	150	0.657	0.657	1.510	
6	300	0.490	0.490	3.658	*

Dunnett table value = 2.33 (1 Tailed Value, P=0.05, df=30,5)

Dimethyl disulfide & radish weight (g)
File: 1202rw Transform: NO TRANSFORMATION

DUNNETTS 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	Neg control	6			
2	18.8	6	0.180	23.3	-0.035
3	37.5	6	0.180	23.3	-0.038
4	75	6	0.180	23.3	0.003
5	150	6	0.180	23.3	0.117
6	300	6	0.180	23.3	0.283

Dimethyl disulfide & radish weight (g)
File: 1202rw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Neg control	6	0.774	0.774	0.798
2	18.8	6	0.809	0.809	0.798
3	37.5	6	0.812	0.812	0.798
4	75	6	0.771	0.771	0.771
5	150	6	0.657	0.657	0.657
6	300	6	0.490	0.490	0.490

Dimethyl disulfide & radish weight (g)
File: 1202rw Transform: NO TRANSFORMATION

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Neg control	0.798				

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

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18.8	0.798	0.319	1.70	k= 1, v=30
37.5	0.798	0.319	1.78	k= 2, v=30
75	0.771	0.035	1.80	k= 3, v=30
150	0.657	1.519	1.81	k= 4, v=30
300	0.490	3.679	1.82	k= 5, v=30

s = 0.133

Note: df used for table values are approximate when v > 20.

Estimates of EC%

Parameter	Estimate	95% Bounds		Std.Err.	Lower Bound /Estimate
		Lower	Upper		
EC5	76.	26.	2.2E+02	0.23	0.34
EC10	1.1E+02	49.	2.5E+02	0.17	0.45
EC25	2.0E+02	1.3E+02	3.0E+02	0.086	0.67
EC50	3.9E+02	2.6E+02	5.9E+02	0.087	0.67

Slope = 2.30 Std.Err. = 0.898

Goodness of fit: p = 0.94 based on DF= 3.0 30.

1202RW : Dimethyl disulfide & radish weight (g)

Observed vs. Predicted Treatment Group Means

Dose	#Reps.	Obs. Mean	Pred. Mean	Obs. -Pred.	Pred. %Control	%Change
0.00	6.00	0.774	0.801	-0.0275	100.	0.00
18.8	6.00	0.809	0.800	0.00875	99.9	0.116
37.5	6.00	0.812	0.794	0.0182	99.1	0.928
75.0	6.00	0.771	0.762	0.00856	95.2	4.84
150.	6.00	0.657	0.668	-0.0111	83.3	16.7
300.	6.00	0.490	0.487	0.00304	60.8	39.2

!!!Warning: EC50 not bracketed by doses evaluated.

Dimethyl disulfide & oat survival

File: 1202as Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	0	2	30	4	0

Calculated Chi-Square goodness of fit test statistic = 31.7407

Table Chi-Square value (alpha = 0.01) = 13.277

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

Dimethyl disulfide & oat survival

File: 1202as Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 1.333

W = 0.528

Critical W (P = 0.05) (n = 36) = 0.935

Critical W (P = 0.01) (n = 36) = 0.912

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & oat survival

File: 1202as Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance

Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption. Additional transformations are useless.

Dimethyl disulfide & oat survival

File: 1202as Transform: NO TRANSFORMATION

STEELS MANY-ONE RANK TEST

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Neg control	5.000				
2	18.8	5.000	39.00	25.00	6.00	
3	37.5	5.000	39.00	25.00	6.00	
4	75	5.000	39.00	25.00	6.00	
5	150	5.000	39.00	25.00	6.00	
6	300	4.667	33.00	25.00	6.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

1202AS : Dimethyl disulfide & oat survival

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
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0

5

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}	EPA MRID Number 47471202			
18.8	5	0	N.S.	
37.5	5	0	N.S.	
75	5	0	N.S.	
150	5	0	N.S.	
300	4.67	2.739	0.006	*

"*"=Significant; "N.S."=Not Significant.

!!!Failure #3: Data not suitable for probit model fit.

Criterion is 3 or more distinct isotone means.

Dimethyl disulfide & lettuce survival
File: 1202gs Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	1	1	32	2	0

Calculated Chi-Square goodness of fit test statistic = 39.4504
Table Chi-Square value (alpha = 0.01) = 13.277

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & lettuce survival
File: 1202gs Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 13.500

W = 0.539

Critical W (P = 0.05) (n = 36) = 0.935
Critical W (P = 0.01) (n = 36) = 0.912

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & lettuce survival
File: 1202gs Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance
Bartlett's test for homogeneity of variance

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

Dimethyl disulfide & lettuce survival
File: 1202gs Transform: NO TRANSFORMATION

STEELS MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Neg control	5.000				
2	18.8	5.000	39.00	25.00	6.00	
3	37.5	5.000	39.00	25.00	6.00	
4	75	5.000	39.00	25.00	6.00	
5	150	5.000	39.00	25.00	6.00	
6	300	2.500	21.00	25.00	6.00	*

Critical values use k = 5, are 1 tailed, and alpha = 0.05

1202GS : Dimethyl disulfide & lettuce survival

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	5	.		
18.8	5	0	N.S.	
37.5	5	0	N.S.	
75	5	0	N.S.	
150	5	0	N.S.	
300	2.5	6.455	<0.005	*

"*"=Significant; "N.S."=Not Significant.

!!!Failure #3: Data not suitable for probit model fit.

Criterion is 3 or more distinct isotone means.

Dimethyl disulfide & Radish survival
File: 1202rs Transform: NO TRANSFORMATION

Chi-square test for normality: actual and expected frequencies

INTERVAL	<-1.5	-1.5 to <-0.5	-0.5 to 0.5	>0.5 to 1.5	>1.5
EXPECTED	2.412	8.712	13.752	8.712	2.412
OBSERVED	0	3	30	3	0

Calculated Chi-Square goodness of fit test statistic = 31.5111

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

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Table Chi-Square value (alpha = 0.01) = 13.277

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & Radish survival
File: 1202rs Transform: NO TRANSFORMATION

Shapiro Wilks test for normality

D = 1.500

W = 0.576

Critical W (P = 0.05) (n = 36) = 0.935
Critical W (P = 0.01) (n = 36) = 0.912

Data FAIL normality test. Try another transformation.

Warning - The two homogeneity tests are sensitive to non-normal data and should not be performed.

Dimethyl disulfide & Radish survival
File: 1202rs Transform: NO TRANSFORMATION

Hartley test for homogeneity of variance
Bartlett's test for homogeneity of variance

These two tests can not be performed because at least one group has zero variance.

Data FAIL to meet homogeneity of variance assumption.
Additional transformations are useless.

Dimethyl disulfide & Radish survival
File: 1202rs Transform: NO TRANSFORMATION

STEELS MANY-ONE RANK TEST - Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	df	SIG
1	Neg control	5.000				
2	18.8	5.000	39.00	25.00	6.00	
3	37.5	5.000	39.00	25.00	6.00	
4	75	5.000	39.00	25.00	6.00	
5	150	5.000	39.00	25.00	6.00	
6	300	4.500	30.00	25.00	6.00	

Critical values use k = 5, are 1 tailed, and alpha = 0.05

Data Evaluation Report on the Acute Toxicity of Dimethyl Disulfide to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47471202

1202RS : Dimethyl disulfide & Radish survival

Williams Test

[One-Sided Test for Decrease, alpha = 0.050000]

Dose	Isotone Means	T-bar	P-value	Significance
0	5	.		
18.8	5	0	N.S.	
37.5	5	0	N.S.	
75	5	0	N.S.	
150	5	0	N.S.	
300	4.5	3.873	<0.005	*

***=Significant; "N.S."=Not Significant.

!!!Failure #3: Data not suitable for probit model fit.

Criterion is 3 or more distinct isotone means.