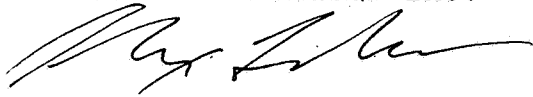


MRID No. 445050-11

**DATA EVALUATION RECORD
FRESHWATER FISH EARLY LIFE-STAGE TEST
GUIDELINE 72-4**

1. **CHEMICAL:** Mesotrione **PC Code No.:** 122990
2. **TEST MATERIAL:** ZA1296 **Purity:** 97.6%
3. **CITATION:**

Authors: N. Shillabeer and S.J. Kent
Title: ZA1296: Chronic Toxicity Test to Fathead Minnow (*Pimephales promelas*) Embryos and Larvae
Study Completion Date: December 21, 1996
Laboratory: Brixham Environmental Laboratory, Brixham Devon, UK
Laboratory Report ID: BL5925/B
Sponsor: ZENECA Ag Products, Wilmington, DE
MRID No.: 445050-11
DP Barcode: D245475
4. **REVIEWED BY:** Max Feken, M.S., Environmental Toxicologist, Golder Associates Inc.

Signature:  **Date:** 8/25/98

APPROVED BY: Pim Kosalwat, Ph.D., Senior Scientist, Golder Associates Inc.
Signature: P. Kosalwat **Date:** 8/25/98
5. **APPROVED BY:** 

Signature:  **Date:** 6/15/99
6. **CONCLUSIONS:** This study is scientifically sound and fulfills the guideline requirements for a fish early life-stage toxicity test. Based on the most sensitive parameter (larval length), the NOEC and LOEC for fathead minnows exposed to ZA1296 were 11 and 23 ppm, respectively. The geometric mean MATC was determined to be 16 ppm.
7. **ADEQUACY OF THE STUDY:**
 - A. Classification: Core
 - B. Rationale: N/A
 - C. Repairability: N/A

8. **MAJOR GUIDELINE DEVIATIONS:** The dilution water consisted of dechlorinated tap water.

9. **MATERIALS AND METHODS:**

A. **Biological System:**

Guideline Criteria	Reported Information
Species: A freshwater or saltwater fish species.	<i>Pimephales promelas</i>
Source: Commercial fishery, wild, or brood stock.	In-house brood stock
Age at beginning of test: Embryos 2 to 24 hours old.	<24 hours old at initiation
Replicates: Minimum of 20 embryos per replicate cup, 4 replicates per concentration. Minimum of 30 fish per treatment for posthatch exposure.	20 embryos/incubation cup, 1 cups/chamber, 4 replicate chambers/level. At least 16 fish/chamber, 4 replicate chambers/level.
Posthatch: % of embryos that produce live fry must be $\geq 50\%$ in each control; % hatch in any control embryo cup must be no more than 1.6 times that in another control cup.	93% egg hatch in the control group 1.2 times
Feeding: Fish should be fed at least twice daily. Fish should not be fed for at least 24 hr prior to termination on day 32.	Larvae were fed three times a day during the week and twice a day on weekends. Up to day 3 post hatch, larvae received freshwater rotifers. After Day 5, fry were fed brine shrimp (<i>Artemia salina</i>). Diet was replaced with high protein pelleted fish food for one of the daily feeds after Day 15. Food was withheld 48 hours before study termination.
Counts: At a minimum, live fish should be counted 11, 18, 25, and 32 days after hatching.	Embryos and fish were counted daily.

Guideline Criteria	Reported Information
Controls: Avg. survival at end of test must be $\geq 80\%$. Survival in any control chamber must not be $< 70\%$.	Survival averaged 97% in the control. Survival in each control replicate was $\geq 94\%$.
Controls: Negative control and carrier control (when applicable) are required.	Dilution water control; no solvent was used.

Comments: None

B. Physical System:

Guideline Criteria	Reported Information
Test Water: 1) May be natural (well or spring) or reconstituted water. 2) Water should be sterilized with UV radiation and screened for contaminants. 3) Hardness of 40-48 mg/L as CaCO_3 , pH of 7.2-7.6	1) Filtered tap water dechlorinated with sodium thiosulphate. 2) The water was UV sterilized and screened for contaminants. 3) Hardness of 44.6 mg/L as CaCO_3 , pH of 6.63 - 7.94.
Test Temperature: Depends upon test species; should not deviate by more than 2°C from appropriate temperature. For fathead minnow, 25°C is recommended.	24.2 - 25.1°C
Photoperiod: Recommend 16L/8D.	16 h light, 8 h dark
Dosing Apparatus: Intermittent flow proportional diluters or continuous flow serial diluters should be used. A minimum of 5 toxicant concentrations with a dilution factor not greater than 0.5 and controls should be used.	Continuous-flow diluter Control and 5 toxicant concentrations with a dilution factor of 0.5

Guideline Criteria	Reported Information
Toxicant Mixing: 1) Mixing chamber is recommended but not required; 2) Aeration should not be used for mixing; 3) It must be demonstrated that the test solution is completely mixed before intro. into the test system; 4) Flow splitting accuracy must be within 10%.	1) Mixing chamber used 2) No aeration of exposure solutions 3) Mixing confirmed by analysis 4) Flow splitting accuracy was not reported.
Test Vessels: All glass or glass with stainless steel frame.	12-L glass aquaria maintained with a test volume of approximately 9.5 L.
Embryo Cups: 120 mL glass jars with bottoms replaced with 40 mesh stainless steel or nylon screen.	Glass cylinders (50-mm diameter) with 470- μ m nylon screen mesh bottoms.
Flow Rate: Flow rates to larval cups should provide 90% replacement in 8-12 hours. Flow rate must maintain DO at above 75% of saturation and maintain the toxicant level.	Approx. 6 volume additions/24 hours. DO and chemical concentrations confirmed by analysis.
Aeration: Dilution water should be aerated to insure DO concentration at or near 100% saturation. Test tanks and embryo cups should not be aerated.	DO $\geq$ 80% (6.8 mg/L) of saturation at all times

Comments: None

C. Chemical System:

Guideline Criteria	Reported Information
Concentrations: Minimum of 5 concentrations and a control, all replicated, plus solvent control if appropriate. - Toxicant conc. must be measured in one tank at each toxicant level every week. - One concentration must adversely affect a life stage and one concentration must not affect any life stage.	- Negative control, 12.5, 25, 50, 100, and 200 mg/L. - Samples from one replicate of the control and each test concentration were collected on Days 0, 2, 3, 11, 18, 24, and 31. Samples were collected from all replicates of the 50, 100, and 200 mg/L treatment levels on Days 5, 20, and 36; and from all replicates of the control 12.5, and 25 mg/L treatment levels on Days 1, 13, and 28. - LOEC and NOEC were obtained.
Other Variables: DO must be measured at each conc. at least once a week.	DO was measured at Day 0 and then twice weekly in all replicates throughout the test.
Solvents: Should not exceed 0.1 mL/L in a flow-through system. Following solvents are acceptable: dimethylformamide, triethylene glycol, methanol, acetone, ethanol.	No solvent was used

Comments: To aid in the dissolution of the test substance 58 g of sodium hydroxide was added to the initial stock solution.

Mean measured concentrations were 88-97% of nominal.

10. REPORTED RESULTS:

Guideline Criteria	Reported Information
Data Endpoints must include: - Number of embryos hatched; - Time to hatch; - Mortality of embryos, larvae, and juveniles; - Time to swim-up (if approp.); - Measurement of growth; - Incidence of pathological or histological effects; - Observations of other effects or clinical signs.	Data include: - Number of embryos hatched; - "hatch day" (4 days); - time to swim-up (Days 3-6 post-hatch) - 32-day post-hatch survival; - 32-day post-hatch length; - 32-day post-hatch wet weight - Clinical observations
Raw data included? (Y/N)	Yes

Comments: The "hatch day" was determined to be that day on which the greatest number of larvae were hatched, which was exposure Day 4.

Effects Data

Toxicant Concentration (mg/L)		Mean % Hatch	32-Day Post-hatch % Survival	Total Length (mm)	Wet Weight (mg)
Nominal	Measured				
Control	<0.02	93	97	21.1	140
12.5	11	94	97	21.0	136
25	23	97	96	20.5	129
50	47	96	95	19.8*	123*
100	97	96	90	20.0*	133
200	190	91	95	18.9*	113*

* Statistically reduced compared to the control ($p \leq 0.05$).

Toxicity Observations: By Day 25 post-hatch, several fish in the 200 mg/L nominal treatment level appeared less active with a number of individuals exhibiting spinal deformities and lesions around the tail. One fish exhibited signs of internal bleeding at the 25 mg/L concentration at day 25. After day 28, fish from the three highest concentrations (50, 100, and 200 mg/L nominal) increasingly demonstrated loss of balance, skin lesions in the tail area, and spinal deformities.

Statistical Results: Proportional data was analyzed using 2 x 2 contingency tables. Data on growth were analyzed using analysis of variance for parametric data and Wilcoxon's Rank Sum Test for nonparametric data. Results based on nominal concentrations.

NOEC: 12.5 mg/L **LOEC:** 25 mg/L **MATC:** 18 mg/L

Most sensitive endpoint: Physical symptoms

Comments: The LOEC was based on a single fry in the 25 mg/L nominal concentration that exhibited signs of internal bleeding.

11. REVIEWER'S STATISTICAL RESULTS

Statistical Method: Williams' test on arcsine transformed data for survival and hatchability; Dunnett's test for growth. Results based on mean measured concentrations.

NOEC: 11 ppm **LOEC:** 23 ppm **MATC:** 16 ppm

Most sensitive endpoint: Larval length

Comments: None

12. REVIEWER'S COMMENTS: This study is scientifically sound and fulfills the guideline requirements for a fish early life-stage toxicity test using the fathead minnow. Based on the most sensitive endpoint (length), the MATC for fathead minnows exposed to ZA1296 was between 11 and 23 ppm. The geometric mean MATC was 16 ppm. This study is classified as **Core**.

ZA1296 - FATHEAD PERCENT HATCH

File: 44505011

Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	CONTROL	4	0.925	1.307	1.356
2	11	4	0.938	1.321	1.356
3	23	4	0.975	1.402	1.356
4	47	4	0.963	1.374	1.356
5	97	4	0.963	1.378	1.356
6	190	4	0.913	1.290	1.290

ZA1296 - FATHEAD PERCENT HATCH

File: 44505011

Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model)

TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
CONTROL	1.356				
11	1.356	0.718		1.73	k= 1, v=18
23	1.356	0.718		1.82	k= 2, v=18
47	1.356	0.718		1.85	k= 3, v=18
97	1.356	0.718		1.86	k= 4, v=18
190	1.290	0.238		1.87	k= 5, v=18

s = 0.098

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

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ZA1296 - FATHEAD PERCENT SURVIVAL (32 DAYS)

File: 44505011

Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model)

TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	CONTROL	4	0.970	1.391	1.394
2	11	4	0.972	1.397	1.394
3	23	4	0.960	1.374	1.374
4	47	4	0.948	1.356	1.356
5	97	4	0.895	1.246	1.292
6	190	4	0.945	1.339	1.292

ZA1296 - FATHEAD PERCENT SURVIVAL (32 DAYS)

File: 44505011

Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model)

TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
CONTROL	1.394				
11	1.394	0.040		1.73	k= 1, v=18
23	1.374	0.252		1.82	k= 2, v=18
47	1.356	0.521		1.85	k= 3, v=18
97	1.292	1.447		1.86	k= 4, v=18
190	1.292	1.447		1.87	k= 5, v=18

s = 0.096

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

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	72	21.0847222	1.1704892	17.8000000	23.8000000
WEIGHT	72	140.2222222	22.8930288	87.0000000	201.0000000

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	73	20.9890411	1.0937400	17.4000000	23.0000000
WEIGHT	73	136.1232877	20.8745893	81.0000000	176.0000000

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	73	20.4821918	1.6685275	12.6000000	22.7000000
WEIGHT	73	128.5890411	27.7997980	28.0000000	193.0000000

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	73	19.7945205	1.8678486	15.1000000	22.5000000
WEIGHT	73	123.4246575	32.8738827	53.0000000	189.0000000

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	69	20.0130435	1.6474502	15.7000000	24.1000000
WEIGHT	69	132.8985507	39.9643757	63.0000000	352.0000000

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	69	18.9231884	1.7564801	13.9000000	22.8000000
WEIGHT	69	112.9420290	28.7810620	38.0000000	182.0000000

Class	Levels	Values
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Number of observations in data set = 429

ZAI296 - FATHEAD EARLY LIFE-STAGE
 Total Length
 16:59 Thursday, August 13, 1998

General Linear Models Procedure

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	241.10899	30.13862	12.38	0.0001
Error	420	1022.56336	2.43467		
Corrected Total	428	1263.67235			

R-Square	C.V.	Root MSE	LENGTH Mean
0.190800	7.714418	1.5603	20.226

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	234.22211	46.84442	19.24	0.0001
REP	3	6.88688	2.29563	0.94	0.4198
Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	235.43916	47.08783	19.34	0.0001
REP	3	6.88688	2.29563	0.94	0.4198

ZAI296 - FATHEAD EARLY LIFE-STAGE
 Total Length
 16:59 Thursday, August 13, 1998

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: LENGTH

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 420 MSE= 2.434675
 Critical Value of T= 2.95209

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison	Simultaneous Lower Limit	Difference Between Means	Simultaneous Upper Limit
CONT - TRTI	-0.6694	0.0957	0.8608
CONT - TRTII	-0.1625	0.6025	1.3676
CONT - TRTIV	0.2957	1.0717	1.8477
CONT - TRTIII	0.5251	1.2902	2.0553
CONT - TRTV	1.3855	2.1615	2.9375

File:44505011.sas Page 4

ZA1296 - FATHEAD EARLY LIFE-STAGE
Wet Weight 16:59 Thursday, August 13, 1998 26

General Linear Models Procedure Class Level Information

Class	Levels	Values
TRT	6	CONT TRTI TRTII TRTIII TRTIV TRTV
REP	4	A B C D

Number of observations in data set = 429

ZA1296 - FATHEAD EARLY LIFE-STAGE
Wet Weight

General Linear Models Procedure

Dependent Variable: WEIGHT				
Source	DF	Sum of Squares	Mean Square	F Value
Model	8	38229.138	4778.642	5.53
Error	420	362630.559	863.406	
Corrected Total	428	400859.697		
				Pr > F
				0.0001

	R-Square	C.V.	Root MSE	WEIGHT Mean
	0.095368	22.75674	29.384	129.12

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	5	33887.797	6777.559	7.85	0.0001
REP	3	4341.341	1447.114	1.68	0.1715

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	34544.341	6908.868	8.00	0.0001
REP	3	4341.341	1447.114	1.68	0.1715

ZA1296 - FATHEAD EARLY LIFE-STAGE
Wet Weight

General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: WEIGHT

NOTE: This test controls the type-I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 420 MSE= 863.4061
Critical Value of T= 2.95209

Comparisons significant at the 0.05 level are indicated by ****.

	Simultaneous	Simultaneous
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TRTI - CONT	-0.8608	-0.0957	0.6694	***
TRTI - TRTII	-0.2556	0.5068	1.7693	***
TRTI - TRTIV	-0.2026	0.9760	1.7494	***
TRTI - TRTIII	0.4321	1.1945	1.9570	***
TRTI - TRTV	1.2924	2.0659	2.8393	***
TRTII - CONT	-1.3676	-0.6025	0.1625	***
TRTII - TRTI	-1.2693	-0.5068	0.2556	***
TRTII - TRTIV	-0.3043	0.4691	1.2426	***
TRTII - TRTIII	-0.0748	0.6877	1.4501	***
TRTII - TRTV	0.7856	1.5590	2.3324	***
TRTIV - CONT	-1.8477	-1.0717	-0.2957	***
TRTIV - TRTI	-1.7494	-0.9760	-0.2026	***
TRTIV - TRTII	-1.2426	-0.4691	0.3043	***
TRTIV - TRTIII	-0.5549	0.2185	0.9919	***
TRTIV - TRTV	0.3056	1.0899	1.8741	***
TRTIII - CONT	-2.0553	-1.2902	-0.5251	***
TRTIII - TRTI	-1.9570	-1.1945	-0.4321	***
TRTIII - TRTII	-1.4501	-0.6877	0.0748	***
TRTIII - TRTIV	-0.9919	-0.2185	0.5549	***
TRTIII - TRTV	0.0979	0.8713	1.6447	***
TRTV - CONT	-2.9375	-2.1615	-1.3855	***
ZAI296 - FATHEAD	Total	EARLY LIFE-STAGE		
		Length		
				24

General Linear Models Procedure

TRT Comparison	Simultaneous		Difference		Simultaneous	
	Lower Confidence Limit	Upper Confidence Limit	Between Means	Upper Confidence Limit	Lower Confidence Limit	Upper Confidence Limit
TRTV - TRTI	-2.8393	-2.0659	-2.0659	-1.2924	-2.8393	***
TRTV - TRTII	-2.3324	-1.5590	-1.5590	-0.7856	-2.3324	***
TRTV - TRTIV	-1.8741	-1.0899	-1.0899	-0.3056	-1.8741	***
TRTV - TRTIII	-1.6447	-0.8713	-0.8713	-0.0979	-1.6447	***

ZA1296 - FATHEAD	EARLY LIFE-STAGE	25
	Total Length	
	16:59 Thursday, August 13, 1998	

General Linear Models Procedure

Dunnett's One-tailed T tests for variable: LENGTH

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 420 MSE= 2.434675
Critical Value of Dunnett's T= 2.242

Comparisons significant at the 0.05 level are indicated by ***.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
TRT I - CONT	-0.6766	-0.0957	0.4852
TRT II - CONT	-1.1835	-0.6025	-0.0216
TRT IV - CONT	-1.6609	-1.0717	-0.4824
TRT II - CONT	-1.8711	-1.2902	-0.7093
TRT V - CONT	-2.7508	-2.1615	-1.5723

TRT Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit
CONT - TRTI	-10.309	4.099	18.507
CONT - TRTIV	-7.290	7.324	21.937
CONT - TRTII	-2.774	11.633	26.041
CONT - TRTIII	2.390	16.798	31.205
CONT - TRTV	12.667	27.280	41.894
TRTI - CONT	-18.507	-4.099	10.309
TRTIV - CONT	-11.340	3.225	17.789
TRTII - CONT	-6.824	7.534	21.892
TRTIII - CONT	-1.659	12.699	27.057
TRTV - CONT	8.617	23.181	37.746
TRTIV - TRTI	-21.937	-7.324	7.290
TRTIV - TRTII	-17.789	-3.225	11.340
TRTIV - TRTIII	-10.255	4.310	18.874
TRTIV - TRTV	-5.091	9.474	24.038
TRTIV - TRTIV	5.188	19.957	34.725
TRTII - CONT	-26.041	-11.633	2.774
TRTII - TRTI	-21.892	-7.534	6.824
TRTII - TRTIV	-18.874	-4.310	10.255
TRTII - TRTIII	-9.193	5.164	19.522
TRTII - TRTV	1.083	15.647	30.211
TRTIII - CONT	-31.205	-16.798	-2.390
TRTIII - TRTI	-27.057	-12.699	1.659
TRTIII - TRTIV	-24.038	-9.474	5.091
TRTIII - TRTII	-19.522	-5.164	9.193
TRTIII - TRTV	-4.082	10.483	25.047
TRTV - CONT	-41.894	-27.280	-12.667

Wet Weight
ZAI296 - FATHEAD EARLY LIFE-STAGE
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General Linear Models Procedure

TRT Comparison	Simultaneous		Simultaneous
	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit
TRTV - TRTI	-37.746	-23.181	-8.617
TRTV - TRTIV	-34.725	-19.957	-5.188
TRTV - TRTII	-30.211	-15.647	-1.083
TRTV - TRTIII	-25.047	-10.483	4.082

ZAI296 - FATHEAD EARLY LIFE-STAGE
Wet Weight
16:59 Thursday, August 13, 1998

General Linear Models Procedure

Dunnett's One-tailed T tests for variable: WEIGHT

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 420 MSE= 863.4061
Critical Value of Dunnett's T= 2.242

Comparisons significant at the 0.05 level are indicated by '***'.

Simultaneous

Simultaneous

TRT Comparison	Lower Confidence Limit	Difference Between Means	Upper Confidence Limit
TRTI - CONT	-15.039	-4.099	6.841
TRTIV - CONT	-18.420	-7.324	3.773
TRTII - CONT	-22.573	-11.633	-0.693
TRTIII - CONT	-27.737	-16.798	-5.858
TRTV - CONT	-38.376	-27.280	-16.184

ANALYSIS USING TRT*REP INTERACTION AS THE ERROR TERM
16:59 Thursday, August 13, 1998

General Linear Models Procedure
Class Level Information

Class	Levels	Values
REP	4	A B C D
TRT	6	CONT TRTI TRTII TRTIII TRTIV TRTV

Number of observations in data set = 429

ANALYSIS USING TRT*REP INTERACTION AS THE ERROR TERM
16:59 Thursday, August 13, 1998

General Linear Models Procedure

Dependent Variable: LENGTH		Sum of Squares		Mean Square	F Value	Pr > F
Source	DF	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	23	274.07292	11.91621	4.88	0.0001
Error	405	405	989.59944	2.44346		
Corrected Total	428	428	1263.67235			
R-Square			C.V.	Root MSE	LENGTH Mean	
			0.216886	7.728316	1.5632	20.226

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	3	5.66983	1.88994	0.77	0.5093
TRT	5	235.43916	47.08783	19.27	0.0001
REP*TRT	15	32.96393	2.19760	0.90	0.5651
Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	3	6.83521	2.27840	0.93	0.4250
TRT	5	241.78056	48.35611	19.79	0.0001
REP*TRT	15	32.96393	2.19760	0.90	0.5651

Tests of Hypotheses using the Type III MS for REP*TRT as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	241.78056	48.35611	22.00	0.0001

ANALYSIS USING TRT*REP INTERACTION AS THE ERROR TERM
16:59 Thursday, August 13, 1998

General Linear Models Procedure

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	23	46251.666	2010.942	2.30	0.0007
Error	405	354608.031	875.575		
Corrected Total	428	400859.697			

R-Square 0.115381
C.V. 22.91655
Root MSE 29.590
WEIGHT Mean 129.12

Source	DF	Type I SS	Mean Square	F Value	Pr > F
REP	3	3684.797	1228.266	1.40	0.2415
TRT	5	34544.341	6908.868	7.89	0.0001
REP*TRT	15	8022.528	534.835	0.61	0.8666

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	3	4470.499	1490.166	1.70	0.1660
TRT	5	34167.359	6833.472	7.80	0.0001
REP*TRT	15	8022.528	534.835	0.61	0.8666

Tests of Hypotheses using the Type III MS for REP*TRT as an error term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	5	34167.359	6833.472	12.78	0.0001

ANALYSIS USING TRT*REP INTERACTION AS THE ERROR TERM

16:59 Thursday, August 13, 1998

General Linear Models Procedure
Least Squares Means

Standard Errors and Probabilities calculated using the Type III MS for REP*TRT as an Error term

TRT	LENGTH LSMEAN	Pr > T 1/2	H0: LSMEAN(i)=LSMEAN(j) 2	3	4	5	6
CONT	21.1032701	1	0.6609	0.0257	0.0001	0.0005	0.0001
TRTI	20.9928019	2	0.6609	0.0596	0.0002	0.0012	0.0001
TRTII	20.4915899	3	0.0257	0.0596	0.0103	0.0661	0.0001
TRTIII	19.7700658	4	0.0001	0.0002	0.0103	0.3777	0.0034
TRTIV	19.9968653	5	0.0005	0.0012	0.0661	0.3777	0.0006
TRTV	18.9012728	6	0.0001	0.0001	0.0034	0.0006	

Standard Errors and Probabilities calculated using the Type III MS for REP*TRT as an Error term

TRT	WEIGHT LSMEAN	Pr > T 1/2	H0: LSMEAN(i)=LSMEAN(j) 2	3	4	5	6
CONT	140.459975	1	0.2781	0.0088	0.0005	0.0675	0.0001
TRTI	136.125903	2	0.2781	0.0777	0.0043	0.4002	0.0001
TRTII	128.859740	3	0.0088	0.0777	0.1641	0.3325	0.0010
TRTIII	123.242599	4	0.0005	0.0043	0.1641	0.0273	0.0182
TRTIV	132.758949	5	0.0675	0.4002	0.3325	0.0273	0.0002
TRTV	112.914147	6	0.0001	0.0001	0.0010	0.0182	0.0002

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: LENGTH

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 15 MSE= 2.197595
Critical Value of Dunnett's T= 2.445

Comparisons significant at the 0.05 level are indicated by ****.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
TRTI - CONT	-0.6978	-0.0957	0.5064	***
TRTII - CONT	-1.2047	-0.6025	-0.0004	***
TRTIII - CONT	-1.6824	-1.0717	-0.4610	***
TRTIV - CONT	-1.8923	-1.2902	-0.6881	***
TRTV - CONT	-2.7723	-2.1615	-1.5508	***

ANALYSIS USING TRT*REP INTERACTION AS THE ERROR TERM

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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: WEIGHT

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 15 MSE= 534.8352
Critical Value of Dunnett's T= 2.445

Comparisons significant at the 0.05 level are indicated by ****.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
TRTI - CONT	-13.492	-4.099	5.294	***
TRTII - CONT	-16.851	-7.324	2.204	***
TRTIII - CONT	-21.026	-11.533	-2.240	***
TRTIV - CONT	-26.191	-16.798	-7.404	***
TRTV - CONT	-36.808	-27.280	-17.753	***