DESCRIPTION OF FINAL REPORT

|  |  |
| --- | --- |
| **EXTRANET CODE** | **3893914** |
| **COMERCIAL NAME** | **CORMORAN 180 EC** |
| **ACTIVE INGREDIENT** | **ACETAMIPRID 80 g/L + NOVALURON 100 g/L** |
| **DESCRIPTION** | **Final report ACETAMIPRID 80 g/L + NOVALURON 100 g/L pest tomato** |
| **SUBJECT:** | **Field trial for development** |
| **2. PLANNED OR PLACED TRIAL:** | **Placed** |
| **3. TRIAL DATE:** | **June 2014 for the final report** |
| **4. TARGET PEST:** | ***Trialeurodes vaporariorum*** |
| **5. WEEDS (HERBICIDES)** | **N/A** |
| **6. PROTOCOL OR FINAL REPORT (ATTACHED):** | **FINAL REPORT** |
| **7. EXPECTED PAYMENT DATE:** | **IMMEDIATE** |
| **9. RESEARCHER NAME:** | **PAOLA ANDREA RODRÍGUEZ** |
| **10. RESEARCHER ADDRESS:** | **Medellín, Colombia** |
| **11. NAMES OF FILES SENT** | **3893914 Final Report ACETAMIPRID 80g/L + NOVALURON 100g/L pest tomato** |
| **NOTES:** | **Report on one location** |

**EFFICACY OF CORMORAN 180 EC (ACETAMIPRID 80 g/L + NOVALURON 100 g/L) IN THE CONTROL OF WHITEFLY (*Trialeurodes vaporariorum*) IN TOMATO CULTIVATION (*Lycopersicum esculentum* L.)**

RESULTS AND RECOMMENDATIONS REPORT

PAOLA ANDREA RODRÍGUEZ

Technical Business Development Coordinator

WILDER FERNANDO VERGARA

Development Assistant

ANTIOQUIA

JUNE 2014

**EFFICACY OF CORMORAN 180 EC (ACETAMIPRID 80 g/L + NOVALURON 100 g/L) IN THE CONTROL OF THRIPS (*Thrips palmi*), WHITEFLY (*Trialeurodes vaporariorum*), AND TOMATO LEAFMINER (*Tuta absoluta*) IN TOMATO CULTIVATION (*Lycopersicum esculentum* L.)**

Summary

A semicommercial trial was performed to evaluate the effect of CORMORAN 180 EC on different tomato crop pests. The ability of the insecticide CORMORAN 180 EC to control thrips, whitefly, and tomato leafminer at the commercial dose of 1.5 mL/L was assessed and compared with the commercial product RIMON DUO 100 SC, RESCATE 200 SP, and an untreated control. The trial was undertaken at El Carmelo commercial farm, located in a district of the same name in the municipality of Santuario. The trial involved two complete plots of 100 m2, with each plot comprising six 15-m-wide rows of beans; 10 plants of the middle rows were selected for the assessment of thrips, tomato leafminer, and whitefly individuals; this was done via direct leaf and total population counts in three traps located in each plot, with yellow traps for whitefly and blue traps for thrips. Two applications were made with an interval of seven days. The assessments to determine the effects of the treatments were performed before insecticide application and at 5 and 7 days after each application. The results revealed the presence of thrips only in the traps, and of whitefly in both the plant foliage and traps; tomato leafminer was absent. The untreated plants showed higher populations of whitefly and thrips in the traps. The plants treated with CORMORAN 180 EC and RIMON DUO 100 SC consistently had lower populations of crop pests during the course of the trial, with a significant difference between RESCATE 200 SP and the untreated control.

EFFICACY OF CORMORAN 180 EC (ACETAMIPRID 80 g/L + NOVALURON 100 g/L) IN THE CONTROL OF THRIPS (*Thrips palmi*), WHITEFLY (Trialeurodes vaporariorum), AND TOMATO LEAFMINER (*Tuta absoluta*) IN TOMATO CULTIVATION (*Lycopersicum esculentum* L.)

1. SPECIFIC OBJECTIVES
   * Demonstrate the efficacy of CORMORAN 180 EC in the control of different tomato crop pests.
   * Assess the phytocompatibility of CORMORAN 180 EC in tomato cultivation.
2. MATERIALS AND METHODS

The work was carried out in El Carmelo farm, located in a district of the same name in the municipality of Santuario in Eastern Antioquia, using a commercial crop of the tomato variety Torrano grown under greenhouse conditions. This municipality was selected because it is a very large producer of tomato and because it has problems with pests, including thrips, whitefly, and tomato leafminer, during all phases of cultivation.

The ability of the product CORMORAN 180 EC to control pests at the commercial dose of 1.5 mL/L was assessed and compared with RIMON DUO 100 SC, RESCATE 200 SP, and an untreated control (Table 1).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TREATMENT** | **BRAND NAME** | **ACTIVE INGREDIENT** | **CONCENTRATION (mL/L)** | **COMMERCIAL DOSE** | **AI DOSE (mL/ha)** |
| **1** | CORMORAN 180 EC | Acetamiprid+Novaluron | 80+100 | 1.5 mL/L | 48+80 |
| **2** | RIMON DUO 100 SC | Bifenthrin+Novaluron | 50+50 | 0.6 L/ha | 30+30 |
| **3** | RESCATE 200 SP | Acetamiprid | 200 | 0.2 kg/ha | 40 |
| **4** | UNTREATED CONTROL | **N/A** | **N/A** | **N/A** | **N/A** |

Notes. \* Dose calculated based on a volume of water per hectare of 400 L for tomato cultivation. Water was applied to the untreated control. Mixture preparation: Water + (Adjuvants if applicable) + Product. The mixture was prepared in soft water with a neutral or slightly acidic pH.

**Table 1.** Treatments evaluated in the trial

Each plot comprised six 15-m-wide rows of beans. In the two central rows, the plants to be evaluated during the trial were marked and traps were installed for the subsequent monitoring of the adult populations of both whitefly and thrips. Ten plants were selected at a uniform height and a branch was marked on each plant to indicate where the direct counting was to be performed of the thrips, whitefly, and tomato leafminer populations. The marked branches were assessed before insecticide application and at 5 and 7 days after each application by counting the population of interest, with the evaluation interval coinciding with the evaluation of the three traps in each plot. Two applications were made at a 7-day interval using a backpack sprayer and a water volume of 400 L/ha.

The control efficacy of each treatment was calculated using the Henderson and Tilton formula:

Efficacy% =

Where:

**(1 −**

n in Co before application × n in T after application

n in Co after application × n in T before application

**) × 100**

n: number of individuals. Co: untreated control.

T: treated plot.

×: multiplied by.

1. RESULTS OF OBJECTIVES

The assessment and application dates for each of the locations are presented in Table 2, whereas the conditions in each of the locations are shown in Table 3.

|  |  |  |
| --- | --- | --- |
| **LOCATION** | **DATE OF APPLICATION** | **DATE OF ASSESSMENT** |
| **El Carmelo farm, El Carmelo settlement, Santuario municipality (Antioquia)** | Application 1: 05/28/2014  Application 2: 06/04/2014 | 0 daa: 05/28/2014  5 daa: 06/02/2014  7 daa: 06/04/2014  5 dab: 06/09/2014  7 dab: 06/11/2014 |

**Table 2.** Assessment and application dates of the semicommercial CORMORAN 180 EC trial in the tomato

|  |  |
| --- | --- |
| **LOCATION** | **1. EL CARMELO** |
| **Municipality** | Santuario |
| **Sowing density** | 1.10 × 0.2 |
| **Age of crop** | 30 das |
| **Application equipment** | Backpack sprayer |
| **Water volume per treatment** | 8.106 |
| **Mixture volume/ha** | 400 L/ha |
| **Water pH and hardness** | 6–36 ppm |
| **Temperature** | 28°C |
| **Relative humidity** | 48% |

**Table 3.** Application data.

Figure 1 shows the results of the whitefly population in the leaves for each treatment administered during the trial.

12.00

**A**

**A**

**A**

**A**

**B**

**CL**

**C**

**C**

**C**

**B**

**B**

**A**

10.00

8.00

**Individuals/leaflet**

6.00

4.00

2.00

0.00

0 daa 5 daa 7 daa 5 dab 7 dab

CORMORAN 180 EC 0.6 L/ha RIMON DUO 100 SC 0.6 L/ha

RESCATE 200 SP 0.2 kg/ha Untreated control

**Figure 1.** Average leaf populations of whitefly nymphs during the trial.

As can be seen in the figure, there was a uniform pest population comprising 2.8–4.5 individuals/leaf at the beginning of the trial. Although there were no significant differences among the different treatments applied at 5 daa, there was a population decrease with all treatments at this first evaluation. In contrast, a significant difference was seen among the treatments at 7 daa, with clear superiority of CORMORAN 180 EC and RIMON DUO 100 SC over RESCATE 200 SP and a clear difference from the untreated control. This pattern was continually evident in the assessments after the second application, with the PROFICOL products being the most effective treatments for controlling this pest. The calculation of the control efficacy of each treatment versus the untreated control is presented in Figure 2, which shows low efficacy of the CORMORAN 180 EC and RIMON DUO 100 SC products at 5 daa. Their efficacy markedly increased in the subsequent evaluations, with CORMORAN 180 EC achieving 80% control until the end of the trial. RIMON DUO 100 SC showed good efficacy during the trial, with its efficacy peaking 7 days after the second application, reaching 93% control. RESCATE 200 SP failed to exceed 70% control in any evaluation and had an average control of 65%.

100

90

80

70

**Efficacy (%)**

60

50

40

30

20

10

0

5 daa 7 daa 5 dab 7 dab

CORMORAN 180 EC 0.6 L/ha RIMON DUO 100 SC 0.6 L/ha

RESCATE 200 SP 0.2 kg/ha

**Figure 2.** Percentage control of whitefly on tomato leaves over time for the evaluated treatments.

The populations of adults in traps for each treatment are presented in Figure 3, which shows a marked difference from the untreated control for the insecticide treatments. CORMORAN 180 EC showed the best response in all evaluations, followed by RIMON DUO 100 SC.

25.0

A

A

A

A

A

B

B

AB

B

B

B

20.0

15.0

**Adults/traps**

10.0

5.0

0.0

0 daa 5 daa 7 daa 5 dab 7 dab

CORMORAN 180 EC RIMON DUO 100 SC RESCATE 200 SP Untreated control

**Figure 3.** Average population of whitefly in traps during the trial in location 1.

The control efficacy of adults determined by trap capture is presented in Figure 4, which shows that treatment with CORMORAN 180 EC exhibited the best percentage control.

80

70

60

**EFFICACY (%)**

50

40

30

20

10

0

5 daa 7 daa 5 dab 7 dab

CORMORAN 180 EC RIMON DUO 100 SC RESCATE 200 SP

**Figure 4.** Percentage control of whitefly in traps over time for the evaluated treatments.

Thrips were not found on the leaves in any of the evaluated treatments; the adult population was only found in traps and at low levels, as presented in Figure 5, which illustrates the best performance of the PROFICOL products in the control of this insect. The efficacy of the treatments is presented in Figure 6, which shows the best performance of CORMORAN 180 EC in the control of the pest, among the evaluated treatments.

8.0

A

7.0

A

A

A

~~A~~

CL

AB

AB

C

B

B

6.0

5.0

**Thrips/trap**

4.0

3.0

2.0

1.0

0.0

0 daa

5 daa

7 daa

5 dab

7 dab

CORMORAN 180 EC RIMON DUO 100 SC RESCATE 200 SP Untreated control

**Figure 5.** Average trap populations of whitefly during the trial, location 1.

90.0

80.0

70.0

60.0

**EFFICACY (%)**

50.0

40.0

30.0

20.0

10.0

0.0

5 daa 7 daa 5 dab 7 dab

CORMORAN 180 EC RIMON DUO 100 SC RESCATE 200 SP

**Figure 6.** Percentage of thrips control in traps over time for the evaluated treatments.

EVALUATION OF PHYTOTOXICITY

Application of CORMORAN 180 EC was not associated with phytotoxicity symptoms in the treated tomato plants. No coloration changes were seen in the plants, nor chlorosis, stunting, spotting, or effects on leaves, flowers, or pods. The plants sprayed with this dose exhibited normal behavior and showed no changes in their physiology. The mixture of PROFICOL insecticides and fungicides for late blight control was stable and indicated no compatibility issues.

1. CONCLUSIONS

* The evaluated location showed the presence of whitefly on leaves and in traps, as well as adult thrips associated with the crop. There was no evidence of tomato leafminer worm.

* Completely untreated plants exhibited higher populations of pests, with significant differences in pest populations from the insecticide-treated plants from the first application.

* Tomato plants treated with CORMORAN 180 EC showed the best control of both whitefly and thrips, with the next best control achieved by RIMON DUO 100 SC. These products exhibited superior control to the commercial product used.

* We recommend the continued use of PROFICOL products for the control of insect pest populations on the tomato because they guarantee high efficacy and can control different biological targets with a single product. The rotation of these products with other active ingredients is key to increasing their control efficacies, as well as their application with prior knowledge of the insect pests and populations requiring treatment.





Appendix 1. Statistical analysis

Statistix 9.0 26/06/2014, 10:22:34 a.m.

**WHITEFLY NYMPHS**

Statistix 9.0 26/06/2014, 10:43:35 a.m.

**Completely Randomized AOV for eva1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | **MS** | **F** | **P** |
| tto | 3 | 17.300 | 5.76667 | 0.91 | 0.4467 |
| Error | 36 | 228.600 | 6.35000 |  |  |
| Total | 39 | 245.900 |  |  |  |

Grand Mean 3.4500 CV 73.04

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Homogeneity of Variances** | | | **F** | **P** |
| Levene's Test | | | 3.22 | 0.0340 |
| O'Brien's Test | | | 2.85 | 0.0508 |
| Brown and Forsythe Test | | | 2.74 | 0.0578 |
| **Welch's Test for Mean Differences** | | | | |
| **Source** | **DF** | **F** | **P** | |
| tto | 3.0 | 1.56 | 0.2315 | |
| Error | 19.5 |  |  | |

Component of variance for between groups -0.05833 Effective cell size 10,0

**tto** **Mean**

1 3.5000

2 2.8000

3 3.0000

4 4.5000

Observations per Mean 10

Standard Error of a Mean 0.7969

Std Error (Diff of 2 Means) 1.1269

**Completely Randomized AOV for eva2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| tto | 3 | 42.875 | | 14.2917 | | 1.95 | 0.1386 |
| Error | 36 | 263.500 | | 7.3194 | |  |  |
| Total | 39 | 306.375 | |  | |  |  |
| Grand Mean 2.8750 CV 94.10 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 2.80 | 0.0538 | |
| O'Brien's Test | | | | | 2.48 | 0.0767 | |
| Brown and Forsythe Test | | | | | 1.89 | 0.1480 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| tto | 3.0 | | 4.51 | 0.0164 | | | |
| Error | 17.4 | |  |  | | | |

Component of variance for between groups 0.69722

Effective cell size 10,0

|  |  |
| --- | --- |
| **tto** | **Mean** |
| 1 | 2.7000 |
| 2 | 2.3000 |
| 3 | 1.9000 |
| 4 | 4.6000 |

Observations per Mean 10

Standard Error of a Mean 0.8555

Std Error (Diff of 2 Means) 1.2099

**Completely Randomized AOV for eva3**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | **MS** | **F** | **P** |
| tto | 3 | 749.875 | 249.958 | 63.33 | 0.0000 |
| Error | 36 | 142.100 | 3.947 |  |  |
| Total | 39 | 891.975 |  |  |  |

Grand Mean 4.5250 CV 43.91

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Homogeneity of Variances** | | | **F** | **P** |
| Levene's Test | | | 0.07 | 0.9763 |
| O'Brien's Test | | | 0.06 | 0.9801 |
| Brown and Forsythe Test | | | 0.81 | 0.4945 |
| **Welch's Test for Mean Differences** | | | | |
| **Source** | **DF** | **F** | **P** | |
| tto | 3.0 | 62.35 | 0.0000 | |
| Error | 20.0 |  |  | |

Component of variance for between groups 24.6011 Effective cell size 10,0

|  |  |
| --- | --- |
| **tto** | **Mean** |
| 1 | 0.800 |
| 2 | 1.200 |
| 3 | 4.500 |
| 4 | 11.600 |

Observations per Mean 10

Standard Error of a Mean 0.6283

Std Error (Diff of 2 Means) 0.8885

**Completely Randomized AOV for eva4**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| tto | 3 | 481.675 | | 160.558 | | 36.75 | 0.0000 |
| Error | 36 | 157.300 | | 4.369 | |  |  |
| Total | 39 | 638.975 | |  | |  |  |
| Grand Mean 3.9750 CV 52.59 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 2.08 | 0.1198 | |
| O'Brien's Test | | | | | 1.84 | 0.1566 | |
| Brown and Forsythe Test | | | | | 0.56 | 0.6470 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| tto | 3.0 | | 24.43 | 0.0000 | | | |
| Error | 19.5 | |  |  | | | |

Component of variance for between groups 15.6189

Effective cell size 10,0

**tto** **Mean**

1 1.1000

2 1.6000

3 3.4000

4 9.8000

Observations per Mean 10

Standard Error of a Mean 0.6610

Std Error (Diff of 2 Means) 0.9348

**Completely Randomized AOV for eva5**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | **MS** | **F** | **P** |
| tto | 3 | 525.800 | 175.267 | 33.60 | 0.0000 |
| Error | 36 | 187.800 | 5.217 |  |  |
| Total | 39 | 713.600 |  |  |  |

Grand Mean 3.6000 CV 63.44

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Homogeneity of Variances** | | | **F** | **P** |
| Levene's Test | | | 2.72 | 0.0589 |
| O'Brien's Test | | | 2.41 | 0.0832 |
| Brown and Forsythe Test | | | 2.84 | 0.0516 |
| **Welch's Test for Mean Differences** | | | | |
| **Source** | **DF** | **F** | **P** | |
| tto | 3.0 | 25.86 | 0.0000 | |
| Error | 18.1 |  |  | |

Component of variance for between groups 17.0050

Effective cell size 10,0

**tto** **Mean**

1 1.1000

2 0.4000

3 3.3000

4 9.6000

Observations per Mean 10

Standard Error of a Mean 0.7223

Std Error (Diff of 2 Means) 1.0214

Statistix 9.0 26/06/2014, 10:43:56 a.m.

**Tukey HSD All-Pairwise Comparisons Test of eva1 by tto tto** **Mean Homogeneous Groups**

4 4.5000 A

1 3.5000 A

3 3.0000 A

2 2.8000 A

Alpha 0.05 Standard Error for Comparison 1.1269

Critical Q Value 3,810 Critical Value for Comparison 3.0358

There are no significant pairwise differences among the means.

**Tukey HSD All-Pairwise Comparisons Test of eva2 by tto tto** **Mean Homogeneous Groups**

4 4.6000 A

1 2.7000 A

2 2.3000 A

3 1.9000 A

Alpha 0.05 Standard Error for Comparison 1.2099

Critical Q Value 3,810 Critical Value for Comparison 3.2593

There are no significant pairwise differences among the means.

**Tukey HSD All-Pairwise Comparisons Test of eva3 by tto**

|  |  |  |
| --- | --- | --- |
| **tto** | **Mean** | **Homogeneous Groups** |
| 4 | 11.600 | A |
| 3 | 4.5000 | B |
| 2 | 1.2000 | C |
| 1 | 0.8000 | C |

|  |  |  |  |
| --- | --- | --- | --- |
| Alpha | 0.05 | Standard Error for Comparison | 0.8885 |
| Critical Q Value | 3,810 | Critical Value for Comparison | 2.3935 |

There are 3 groups (A, B, etc.) in which the means are not significantly different from one another.

**Tukey HSD All-Pairwise Comparisons Test of eva4 by tto tto** **Mean Homogeneous Groups**

4 9.8000 A

3 3.4000 B

2 1.6000 B

1 1.1000 B

|  |  |  |  |
| --- | --- | --- | --- |
| Alpha | 0.05 | Standard Error for Comparison | 0.9348 |
| Critical Q Value | 3,810 | Critical Value for Comparison | 2.5182 |

There are 2 groups (A and B) in which the means are not significantly different from one another.

**Tukey HSD All-Pairwise Comparisons Test of eva5 by tto tto** **Mean Homogeneous Groups**

4 9.6000 A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 3.3000 | B | | | |
| 1 1.1000 | BC | | | |
| 2 0.4000 | C | | | |
| Alpha | | 0.05 | Standard Error for Comparison | 1.0214 |
| Critical Q Value | | 3,810 | Critical Value for Comparison | 2.7515 |

There are 3 groups (A, B, etc.) in which the means are not significantly different from one another.

Mosca blanca en trampas

Statistix 9.0 26/06/2014, 11:31:17 a.m.

**Completely Randomized AOV for eva1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| trat | 3 | 112.01 | | 37.337 | | 0.35 | 0.7907 |
| Error | 10 | 1069.42 | | 106.942 | |  |  |
| Total | 13 | 1181.43 | |  | |  |  |
| Grand Mean 17.429 CV 59.34 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 3.48 | 0.0582 | |
| O'Brien's Test | | | | | 2.16 | 0.1565 | |
| Brown and Forsythe Test | | | | | 4.80 | 0.0253 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| trat | 3.0 | | 0.37 | 0.7758 | | | |
| Error | 5.0 | |  |  | | | |

Component of variance for between groups -20.0232 Effective cell size 3,5

|  |  |  |  |
| --- | --- | --- | --- |
| **trat** | **N** | **Mean** | **SE** |
| 1 | 3 | 14.333 | 5.9705 |
| 2 | 3 | 14.000 | 5.9705 |
| 3 | 4 | 20.000 | 5.1706 |
| 4 | 4 | 19.750 | 5.1706 |

**Completely Randomized AOV for eva2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| trat | 3 | 450.94 | | 150.313 | | 1.85 | 0.2015 |
| Error | 10 | 811.42 | | 81.142 | |  |  |
| Total | 13 | 1262.36 | |  | |  |  |
| Grand Mean 12.214 CV 73.75 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 1.43 | 0.2910 | |
| O'Brien's Test | | | | | 0.91 | 0.4721 | |
| Brown and Forsythe Test | | | | | 0.94 | 0.4589 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| trat | 3.0 | | 1.26 | 0.3905 | | | |
| Error | 4.5 | |  |  | | | |

Component of variance for between groups 19.8987 Effective cell size 3,5

**trat N** **Mean** **SE**

|  |  |
| --- | --- |
| 1 3 | 7.000 5.2007 |
| 2 3 | 8.333 5.2007 |
| 3 4 | 10.250 4.5039 |
| 4 4 | 21.000 4.5039 |

**Completely Randomized AOV for eva3**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| trat | 3 | 228.083 | | 76.0278 | | 3.40 | 0.0615 |
| Error | 10 | 223.417 | | 22.3417 | |  |  |
| Total | 13 | 451.500 | |  | |  |  |
| Grand Mean 8.5000 CV 55.61 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 2.88 | 0.0895 | |
| O'Brien's Test | | | | | 1.31 | 0.3248 | |
| Brown and Forsythe Test | | | | | 0.83 | 0.5093 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| trat | 3.0 | | 2.71 | 0.1610 | | | |
| Error | 4.7 | |  |  | | | |

Component of variance for between groups 15.4439

Effective cell size 3,5

**trat N** **Mean** **SE**

|  |  |
| --- | --- |
| 1 3 | 6.000 2.7290 |
| 2 3 | 7.333 2.7290 |
| 3 4 | 5.000 2.3633 |
| 4 4 | 14.750 2.3633 |

**Completely Randomized AOV for eva4**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| trat | 3 | 388.024 | | 129.341 | | 27.62 | 0.0000 |
| Error | 10 | 46.833 | | 4.683 | |  |  |
| Total | 13 | 434.857 | |  | |  |  |
| Grand Mean 10.714 CV 20.20 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 1.86 | 0.2002 | |
| O'Brien's Test | | | | | 1.03 | 0.4202 | |
| Brown and Forsythe Test | | | | | 1.73 | 0.2235 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| trat | 3.0 | | 27.33 | 0.0019 | | | |
| Error | 4.8 | |  |  | | | |

Component of variance for between groups 35.8605 Effective cell size 3,5

**trat N** **Mean** **SE**

|  |  |
| --- | --- |
| 1 3 | 5.333 1.2494 |
| 2 3 | 7.333 1.2494 |
| 3 4 | 9.250 1.0821 |
| 4 4 | 18.750 1.0821 |

**Completely Randomized AOV for eva5**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| trat | 3 | 273.524 | | 91.1746 | | 8.04 | 0.0051 |
| Error | 10 | 113.333 | | 11.3333 | |  |  |
| Total | 13 | 386.857 | |  | |  |  |
| Grand Mean 7.7143 CV 43.64 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 3.91 | 0.0438 | |
| O'Brien's Test | | | | | 2.50 | 0.1192 | |
| Brown and Forsythe Test | | | | | 5.17 | 0.0206 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| trat | 3.0 | | 7.50 | 0.0223 | | | |
| Error | 5.5 | |  |  | | | |

Component of variance for between groups 22.9680 Effective cell size 3,5

|  |  |  |
| --- | --- | --- |
| **trat N** | **Mean** | **SE** |
| 1 3 | 3.333 | 1.9437 |
| 2 3 | 3.333 | 1.9437 |
| 3 4 | 8.000 | 1.6833 |
| 4 4 | 14.000 | 1.6833 |

Statistix 9.0 26/06/2014, 11:36:20 a.m.

**Tukey HSD All-Pairwise Comparisons Test of eva1 by trat trat** **Mean Homogeneous Groups**

3 20.000 A

4 19.750 A

1 14.333 A

2 14.000 A

|  |  |  |
| --- | --- | --- |
| Alpha | 0.05 | Standard Error for Comparison 7.3124 TO 8.4436 |
| Critical Q Value | 4,334 | Critical Value for Comparison 22.407 TO 25.874 |

There are no significant pairwise differences among the means.

**Tukey HSD All-Pairwise Comparisons Test of eva2 by trat trat Mean Homogeneous Groups**

4 21.000 A

3 10.250 A

2 8.3333 A

1 7.0000 A

Alpha 0.05 Standard Error for Comparison 6.3695 TO 7.3549 Critical Q Value 4,334 Critical Value for Comparison 19.518 TO 22.538 There are no significant pairwise differences among the means.

**Tukey HSD All-Pairwise Comparisons Test of eva3 by trat trat Mean Homogeneous Groups**

4 14.750 A

2 7.3333 A

1 6.0000 A

3 5.0000 A

Alpha 0.05 Standard Error for Comparison 3.3423 TO 3.8593 Critical Q Value 4,334 Critical Value for Comparison 10.242 TO 11.826 There are no significant pairwise differences among the means.

**Tukey HSD All-Pairwise Comparisons Test of eva4 by trat trat Mean Homogeneous Groups**

4 18.750 A

3 9.2500 B

2 7.3333 B

1 5.3333 B

Alpha 0.05 Standard Error for Comparison 1.5303 TO 1.7670 Critical Q Value 4,334 Critical Value for Comparison 4.6891 TO 5.4146 There are 2 groups (A and B) in which the means

are not significantly different from one another.

**Tukey HSD All-Pairwise Comparisons Test of eva5 by trat trat Mean Homogeneous Groups**

4 14.000 A

3 8.0000 AB

1 3.3333 B

2 3.3333 B

|  |  |  |  |
| --- | --- | --- | --- |
| Alpha | 0.05 | Standard Error for Comparison | 2.3805 TO 2.7487 |
| Critical Q Value | 4,334 | Critical Value for Comparison | 7.2945 TO 8.4229 |

There are 2 groups (A and B) in which the means are not significantly different from one another.

Statistix 9.0 26/06/2014, 01:48:31 p.m.

**Completely Randomized AOV for Eva1**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| tto | 3 | 58.6833 | | 19.5611 | | 8.20 | 0.0038 |
| Error | 11 | 26.2500 | | 2.3864 | |  |  |
| Total | 14 | 84.9333 | |  | |  |  |
| Grand Mean 4.0667 CV 37.99 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 1.17 | 0.3648 | |
| O'Brien's Test | | | | | 0.73 | 0.5570 | |
| Brown and Forsythe Test | | | | | 0.31 | 0.8195 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| tto | 3.0 | | 4.80 | 0.0508 | | | |
| Error | 5.8 | |  |  | | | |

Component of variance for between groups 4.60038 Effective cell size 3,7

**tto N** **Mean** **SE**

1 4 7.2500 0.7724

2 3 2.0000 0.8919

3 4 3.2500 0.7724

4 4 3.2500 0.7724

**Completely Randomized AOV for Eva2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| tto | 3 | 52.667 | | 17.5556 | | 1.46 | 0.2800 |
| Error | 11 | 132.667 | | 12.0606 | |  |  |
| Total | 14 | 185.333 | |  | |  |  |
| Grand Mean 4.3333 CV 80.14 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 0.93 | 0.4573 | |
| O'Brien's Test | | | | | 0.56 | 0.6498 | |
| Brown and Forsythe Test | | | | | 0.27 | 0.8477 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| tto | 3.0 | | 1.00 | 0.4583 | | | |
| Error | 5.6 | |  |  | | | |

Component of variance for between groups 1.47186 Effective cell size 3,7

**tto N** **Mean** **SE**

1 4 4.5000 1.7364

2 3 1.6667 2.0050

3 4 3.5000 1.7364

4 4 7.0000 1.7364

**Completely Randomized AOV for Eva3**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| tto | 3 | 20.7667 | | 6.92222 | | 1.81 | 0.2043 |
| Error | 11 | 42.1667 | | 3.83333 | |  |  |
| Total | 14 | 62.9333 | |  | |  |  |
| Grand Mean 3.9333 CV 49.78 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 6.81 | 0.0073 | |
| O'Brien's Test | | | | | 4.35 | 0.0300 | |
| Brown and Forsythe Test | | | | | 6.53 | 0.0085 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| tto | 3.0 | | 5.13 | 0.0431 | | | |
| Error | 6.0 | |  |  | | | |

Component of variance for between groups 0.82738 Effective cell size 3,7

**tto N** **Mean** **SE**

1 4 4.7500 0.9789

2 3 2.3333 1.1304

3 4 3.0000 0.9789

4 4 5.2500 0.9789

**Completely Randomized AOV for Eva4**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | **MS** | | **F** | **P** |
| tto | 3 | 16.0167 | 5.33889 | | 4.55 | 0.0263 |
| Error | 11 | 12.9167 | 1.17424 | |  |  |
| Total | 14 | 28.9333 |  | |  |  |
| Grand Mean 2.0667 CV 52.43 | | | |  |  | |
| **Homogeneity of Variances** | | | | **F** | **P** | |
| Levene's Test | | | | 2.12 | 0.1557 | |
| O'Brien's Test | | | | 1.34 | 0.3120 | |
| Brown and Forsythe Test | | | | 1.80 | 0.2049 | |

**Welch's Test for Mean Differences**

|  |  |  |  |
| --- | --- | --- | --- |
| **Source** | **DF** | **F** | **P** |
| tto | 3.0 | 9.08 | 0.0135 |

Error 5.7

Component of variance for between groups 1.11553

Effective cell size 3,7

**tto N** **Mean** **SE**

1 4 2.7500 0.5418

2 3 1.3333 0.6256

3 4 0.7500 0.5418

4 4 3.2500 0.5418

**Completely Randomized AOV for Eva5**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **SS** | | **MS** | | **F** | **P** |
| tto | 3 | 11.1667 | | 3.72222 | | 2.53 | 0.1107 |
| Error | 11 | 16.1667 | | 1.46970 | |  |  |
| Total | 14 | 27.3333 | |  | |  |  |
| Grand Mean 1.3333 CV 90.92 | | | | |  |  | |
| **Homogeneity of Variances** | | | | | **F** | **P** | |
| Levene's Test | | | | | 0.31 | 0.8188 | |
| O'Brien's Test | | | | | 0.17 | 0.9112 | |
| Brown and Forsythe Test | | | | | 0.09 | 0.9622 | |
| **Welch's Test for Mean Differences** | | | | | | | |
| **Source** | **DF** | | **F** | **P** | | | |
| tto | 3.0 | | 2.08 | 0.2084 | | | |
| Error | 5.8 | |  |  | | | |

Component of variance for between groups 0.60335

Effective cell size 3,7

**tto N** **Mean** **SE**

1 4 1.0000 0.6062

2 3 0.6667 0.6999

3 4 0.7500 0.6062

4 4 2.7500 0.6062