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**DESCRIPTION FOR FINAL REPORT**

|  |  |
| --- | --- |
| **EXTRANET CODE** | **3704313** |
| **COMMERCIAL NAME** | **CORMORAN 180 EC** |
| **ACTIVE INGREDIENT** | **Acetamiprid + Novaluron** |
| **DESCRIPTION** | **Final report, development, tomato *Neoleucinodes elegantalis*** |
| **SUBJECT:** | **Field trial for development** |
| **2. PLANNED OR PLACED TRIAL:** | **Placed** |
| **3. TRIAL DATE:** | **June 2013 for final report** |
| **4. TARGET PEST:** | **Tomato Borer (*Neoleucinodes elegantalis*)** |
| **5. WEEDS (HERBICIDES)** | **NA** |
| **6. PROTOCOL OR FINAL REPORT (ATTACHED):** | **FINAL REPORT** |
| **7. EXPECTED PAYMENT DATE:** | **IMMEDIATE** |
| **9. RESEARCHER NAME:** | **Lorena Cendales** |
| **10. RESEARCHER ADDRESS:** | **Pereira, Colombia** |
| **11. NAMES OF FILES SENT** | **3704313 Final Report Acetamiprid Novaluron Tomato** |
| **NOTES** | **2 location report** |

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**EFFECTIVENESS OF CORMORAN 180 EC (ACETAMIPRID 80g/L + NOVALURON 100 g/L) IN CONTROLLING TOMATO BORER (*Neoleucinodes elegantalis*) WHEN GROWING TOMATOES (*Lycopersicon esculentum* Mill)**

**DEVELOPMENT TRIAL**

**RESULTS AND RECOMMENDATIONS REPORT**

**LORENA CENDALES - Technical Development Coordinator**

**Plantations Zone**

**PEREIRA, RISARALDA**

**JUNE 2013**

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**DEVELOPMENT TRIAL**

**Summary**

The trial was carried out at two locations; the first location was the El Chontaduro farm in the Municipality of Belén de Umbría (Risaralda), at an altitude of 1,950 meters above sea level, with an average temperature of 21ºC, and average rainfall of 2,592 mm per year. The second location was the El Rosario farm in the Municipality of Chinchiná (Caldas), at an altitude of 1,670 meters above sea level, with an average temperature of 22ºC, and average rainfall of 2,200 mm/year. Both locations were sown with Calima Hybrid tomatoes. These zones offer ideal conditions for growing tomatoes and for the development of the tomato borer worm, which attacks this fruit.

Cormoran 180 EC was applied in dosages of 1.0, 1.5, and 2.0 cc/L that were compared with an untreated control. It was applied to plants 40 days after their transplanting in both locations, when the plants began the greatest development of their leaf area. The sowing distance involved a 1.5 m spacing between furrows and 0.3 m between the plants, with a density of 22,000 plants/ha in both of the locations evaluated.

Application was carried out using a commercially available backpack sprayer, with a calibrated pressure regulator providing a net spray coverage of 466 L/ha, with a TXV3 nozzle at a pressure of 30 to 35 PSI used in both locations.

Each plot of land was five meters wide by five furrows long. Within each of these plots there were five plants, each one having five (5) marked fruits measuring 2-3 cm in diameter that had eggs laid by the borer (hyaline eggs) on their surfaces. Seven days after spraying, an evaluation of the application was carried out, counting the number of fruits showing signs that the larvae had entered, with the same evaluation being carried out seven days after that. The phytotoxicity was evaluated in a plot of land adjacent to the trial, five furrows by five meters wide, where double the maximum dose of Cormoran 180 EC was applied, equivalent to 4.0 cc/L. The phytotoxicity was rated on the EWRC scale.

The average results for fruits damaged by the tomato borer enabled the observation that, at a dose of 2.0 cc/L, Cormoran 180 EC stood out from the untreated control and from the other treatments applied, with a 5% statistical confidence level when the pest burden is low.

At the doses evaluated, and at the excess dose of 4.0 cc/L, Cormoran 180 EC did not cause any adverse effects in the tomato plants. The trial recommends applying Cormoran at a rate of 2.0 cc/L for controlling tomato borer in plants 40 days after transplanting, with a volume per hectare of 466 liters.

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**EFFECTIVENESS OF CORMORAN 180 EC (ACETAMIPRID 80g/L + NOVALURON 100 g/L) IN CONTROLLING TOMATO BORER (*Neoleucinodes elegantalis*) WHEN GROWING TOMATOES (*Lycopersicon esculentum* Mill)**

**DEVELOPMENT TRIAL**

**1. SPECIFIC OBJECTIVES**

* To determine the efficacy of CORMORAN 180 EC (ACETAMIPRID 50 g/L + NOVALURON 100 g/L) in controlling tomato borer (*Neoleucinodes elegantalis*) in the fruit when growing tomatoes (*Lycopersicum sculentum L.*).
* To evaluate the phytocompatibility of treatments in the plots.

**2. MATERIALS AND METHODS**

The materials and calibrations used were those mentioned in the insecticides protocol (application equipment and tools for measuring the product); batches of 40 day-old Calima Hybrid tomatoes, in the vegetative growth phase, with an average size of 0.7 m at El Chontaduro and El Rosario. The tomatoes being tested were sown with a distance of 1.5 m between furrows and 0.3 m between plants, equivalent to 22,200 plants per ha.

Agronomic management of the batch was done by the commercial operator, except for aspects relating to the application of active ingredient, which were the responsibility of the trial staff. In accordance with the protocol, the threshold for starting application of the treatments was the presence of tomato borer eggs laid on five fruits measuring 2-3 cm in diameter on each of the plants.

Each plot of land was five meters wide by five furrows long. Within each of these plots, there were five plants, each one having five marked fruits measuring 2-3 cm in diameter which had eggs laid (hyaline eggs) by the borer on their surfaces.

Seven and 14 days after application, an evaluation was made of the application, with the number of fruits that had been penetrated by the larvae being counted in order to tally the number of damaged fruits.

The phytotoxicity was evaluated in a plot of land adjacent to the trial area, measuring 5 furrows by 5 meters long, where double the maximum dose of Cormoran 180 EC was applied, equivalent to 4.0 cc/L. The phytotoxicity was rated using the EWRC scale.

Application was carried out using a commercially available backpack sprayer operating at 30 PSI, with a calibrated pressure regulator and a TXV3 nozzle providing a net spray coverage of 466 L/ha. The net spray coverage calibrated was close to the one used commercially for tomatoes 30-40 days after transplanting (DAT) at the final site (see Table 1).

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**Table 1. Calibration parameters for the CORMORAN 180 EC trial for controlling Tomato Borer Worms.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Calibration | Net spray coverage  (cc) | Net spray coverage 5% error vol.  (cc) | Water x treatment actual vol.  (cc) | Vol. L/ha | Average Vol./ha |
| 1 | 550 | 27.5 | 6,310 | 467.4 | 466 |
| 2 | 540 | 27 | 6,268 | 464.3 |  |
| 3 | 550 | 27.5 | 6,310 | 467.4 |  |

**3. RESULTS ACHIEVED IN RELATION TO THE OBJECTIVE**

**3.1. Analysis of the percent of fruits affected**

**At El Chontaduro**

Graph 1 shows the average number of fruits attacked by tomato borer worms throughout the evaluations at the location sprayed.

The evaluation for this location, conducted seven days after application (7 DAA), shows that the average for the fruits affected in the untreated control was 0.55, equaling Cormoran at a dosage of 1.0 cc/L, followed by treatments of Cormoran 180 EC at dosages of 1.5 and 2.0 cc/L with an average of 0.3 for both. In the last evaluation (14 DAA), while the untreated control stood out from the other treatments, having a 0.95 average for fruits adversely affected, the 180 EC Cormoran treatment with a dosage of 2.0 cc/L had a 0.55 rate for affected fruits.

|  |  |  |  |
| --- | --- | --- | --- |
| 1  0.9  0.8  0.7  0.6  0.5  0.4  0.3  0.2  0.1  0 | **Average Portion of Affected Fruits** | | |
| 0 DAA | 7 DAA | 14 DAA |
| CORMORAN 1.0 cc/L | 0 | 0.55 | 0.9 |
| CORMORAN 1.5 cc/L | 0 | 0.3 | 0.6 |
| CORMORAN 2.0 cc/L | 0 | 0.3 | 0.55 |
| UNTREATED CONTROL | 0 | 0.55 | 0.95 |

**Graph 1. Averages for fruits affected by *Neulocinodes elegantalis*. Location 1. El Chontaduro**

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**Table 2. ANOVA Results for the Damaged Fruits. Location: El Chontaduro. 14 DAA**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **dl** | **SS** | **MS** | **F** | **P** |
| **Block** | 3 | 0.0600 | 0.0200 |  |  |
| **Treatment** | 3 | 0.5000 | 0.1666 | 3.4100 | 0.0666 |
| **Error** | 9 | 0.4400 | 0.0488 |  |  |
| **Total** | 15 | 1.0000 |  |  |  |
| **CV:** **29; 48** |  |  |  |  |  |

Table 2 demonstrates that at 14 DAA, the treatments being compared showed highly significant effects.

Table 3, relating to El Chontaduro, reveals that none of the Cormoran 180 EC treatments stood out statistically from the untreated control, with a 5% statistical confidence level.

**Table 3. Tukey’s Test with a 5% Confidence Interval on the Damaged Fruits. Location: El Chontaduro. 14 DAA**

|  |  |  |
| --- | --- | --- |
| Treatment | Median | Group |
| Untreated Control | 0.95 | A |
| CORMORAN 1.0 cc/L | 0.90 | A |
| CORMORAN 1.5 cc/L | 0.60 | A |
| CORMORAN 2.0 cc/L | 0.55 | A |

**At El Rosario**

Graph 2 shows the percent damage rate for fruits attacked by tomato borer worms throughout the evaluations at the location sprayed.

The evaluation for this location, conducted seven days after application (7 DAA), shows that the average for the fruits affected in the untreated control was 0.9, followed by treatments of Cormoran 180 EC at dosages of 1.0, 1.5 and 2.0 cc/L with an average of 0.7, 0.5 and 0.4 respectively. In the last evaluation (14 DAA), the untreated control stood out from the other treatments, with an average of 1.4 for affected fruits.

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|  |  |  |  |
| --- | --- | --- | --- |
| 1.6  1.4  1.2  1  0.8  0.6  0.2  0 | Average of Fruits Affected | | |
| 0 DAA | 7 DAA | 14 DAA |
| CORMORAN 1.0 cc/L | 0 | 0.7 | 0.9 |
| CORMORAN 1.5 cc/L | 0 | 0.55 | 0.75 |
| CORMORAN 2.0 cc/L | 0 | 0.4 | 0.6 |
| UNTREATED CONTROL | 0 | 0.9 | 1.4 |

**Graph 2. Average values for fruits affected by *Neulocinodes elegantalis*. Location 1. El Rosario**

**Table 4. ANOVA Results for the Damaged Fruits. Location: El Rosario. 14 DAA**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **dl** | **SS** | **MS** | **F** | **P** |
| **Block** | 3 | 0.0875 | 0.0292 |  |  |
| **Treatment** | 3 | 1.4475 | 0.4825 | 5.5500 | 0.0196 |
| **Error** | 9 | 0.7825 | 0.0869 |  |  |
| **Total** | 15 | 2.3175 |  |  |  |
| **CV: 32; 31** |  |  |  |  |  |

Table 4 demonstrates that 14 DAA, the treatments compared showed highly significant effects, with a 5% statistical confidence level.

Table 5, relating to El Rosario, reveals that the Cormoran 180 EC treatment at dosages of 1.0 and 1.5 cc/L did not differ statistically from the untreated control, and that the Cormoran 180 EC treatment at a dosage of 2.0 cc/L stood out from the other treatments, with 5% statistical confidence.

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**Table 5. Tukey’s Test with a 5% Significance Level for the Damaged Fruits. Location: El Rosario. 14 DAA**

|  |  |  |
| --- | --- | --- |
| **Treatment** | **Median** | **Group** |
| Untreated Control | 1.40 | A |
| CORMORAN 1.0 cc/L | 0.90 | AB |
| CORMORAN 1.5 cc/L | 0.75 | AB |
| CORMORAN 2.0 cc/L | 0.60 | B |

**3.2. Meteorological conditions**

During the field trial period, the ambient conditions for growing in the area were normal, with some rainfall.

**3.4. Phytotoxicity**

Cormoran 180 EC SC 4 cc/L, at double the dosage evaluated above, did not adversely affect the tomato plants according to the EWRC rating scale. The plants treated had an EWRC rating of 1 or, in other words, the plants were completely healthy.

**4. DISCUSSION AND CONCLUSIONS**

For El Chontaduro, due to the low pest burden, there were no statistical differences found that were significant at a level of 5%, regarding control of the tomato borer worm *Neoleucinodes elegantalis* 14 days after application. Nevertheless, visually and over a large area, such damage may constitute serious economic losses for farmers, adversely impacting on the crop’s profitability.

For El Rosario, Cormoran 180 EC at dosages of 1.0 and 1.5 cc/L did not effectively control the tomato borer worm *Neoleucinodes elegantalis*. On the other hand, Cormoran 180 EC at a dosage of 2.0 cc/L did control the tomato borer worm up to 14 days after application, demonstrating good control of tomato borer and keeping it at levels that did not adversely affect the crop’s profitability.

Consequently, the aforementioned results enable the following conclusions to be drawn:

1. Cormoran 180 EC at a dosage of 2.0 cc/L provides the best control for tomato borer worm (*Neoleucinodes elegantalis*) when growing tomatoes under field conditions.

2. Cormoran 180 EC at a dosage of 4.0 cc/L was not phytotoxic to the crop.

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**5. RECOMMENDATIONS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Crop** | **Biological Target** | **Dosage** | **RP\*** | **WP\*\*** |
| Tomato | **Tomato Borer Worm (*Neoleucinodes elegantalis*)** | **2.0 cc/L with tomato plants 40 days after transplanting and at a volume of 466 L/ha** |  |  |

**\* RP: Return Period:** Time that passes between application and return of personnel and/or livestock to the treated crop.

\*\* **WP: Waiting Period:** The number of days that have to pass between the last application and harvesting of the treated crop.

1. CORMORAN 180 EC must be applied before the first egg-laying occurs or the advent of eggs on a few fruits and/or when the growing conditions favor the pest’s attack, such as hot, dry weather, the presence of tomato shoots close by, and/or nearby crops infested with tomato borer worm.

2. CORMORAN 180 EC will be more effective if it is applied when the plants are in their active growth phase and the soil has a good humidity level.

3. CORMORAN 180 EC must be applied using spray equipment that guarantees good coverage over the plants.

4. CORMORAN 180 EC, when applied at the indicated dosage, does not pose any phytotoxicity risk for the crop.

5. It is recommended that, once CORMORAN 180 EC is applied, it should be used in rotation with applications of insecticides that utilize other action mechanisms for controlling the tomato borer worm, in order to reduce the risk of breeding resistance.

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**Appendix. Field Data**

**Location: El Chontaduro**

|  |  |  |  |
| --- | --- | --- | --- |
| LOCATION | EL CHONTADURO |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| AFFECTED FRUITS Average | | |  |
| TREATMENT NAME | DAA | BLOCK | Total |
| CORMORAN 1.0 cc/L | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.6 |
| 2 | 0.2 |
| 3 | 0.8 |
| 4 | 0.6 |
| 14 DAA | 1 | 1.2 |
| 2 | 0.8 |
| 3 | 0.8 |
| 4 | 0.8 |
| CORMORAN 1.5 cc/L | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.2 |
| 2 | 0.4 |
| 3 | 0.4 |
| 4 | 0.2 |
| 14 DAA | 1 | 0.4 |
| 2 | 0.8 |
| 3 | 0.8 |
| 4 | 0.4 |
| CORMORAN 2.0 cc/L | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.4 |
| 2 | 0.2 |
| 3 | 0.2 |
| 4 | 0.4 |
| 14 DAA | 1 | 0.6 |
| 2 | 0.6 |
| 3 | 0.4 |
| 4 | 0.6 |
| UNTREATED CONTROL | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.8 |
| 2 | 0.6 |
| 3 | 0.4 |
| 4 | 0.4 |
| 14 DAA | 1 | 1 |
| 2 | 1 |
| 3 | 0.6 |
| 4 | 1.2 |

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**Location: El Rosario**

|  |  |  |  |
| --- | --- | --- | --- |
| LOCATION | EL ROSARIO |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| AFFECTED FRUITS Average | | |  |
| TREATMENT NAME | DAA | BLOCK | Total |
| CORMORAN 1.0 cc/L | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.8 |
| 2 | 0.4 |
| 3 | 0.8 |
| 4 | 0.8 |
| 14 DAA | 1 | 1.2 |
| 2 | 0.4 |
| 3 | 1.2 |
| 4 | 0.8 |
| CORMORAN 1.5 cc/L | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.4 |
| 2 | 0.8 |
| 3 | 0.4 |
| 4 | 0.6 |
| 14 DAA | 1 | 0.6 |
| 2 | 1 |
| 3 | 0.6 |
| 4 | 0.8 |
| CORMORAN 2.0 cc/L | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 0.4 |
| 2 | 0.2 |
| 3 | 0.6 |
| 4 | 0.4 |
| 14 DAA | 1 | 0.6 |
| 2 | 0.4 |
| 3 | 0.8 |
| 4 | 0.6 |
| UNTREATED CONTROL | 0 DAA | 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 7 DAA | 1 | 1 |
| 2 | 1 |
| 3 | 0.6 |
| 4 | 1 |
| 14 DAA | 1 | 1.6 |
| 2 | 1.4 |
| 3 | 1 |
| 4 | 1.6 |

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