

Efficacy of Biological and Chemical Control Agents Against the Potato Psyllid (*Bactericera cockerelli* Šulc) Under Field Conditions

Gabriela Cárdenas-Huamán¹; Henry Morocho-Romero¹; Sebastian Casas-Niño¹; Sandy Vilchez-Navarro¹; Leslie D. Velarde-Apaza¹; Max Ramirez-Rojas¹; Juancarlos Cruz¹; Flavio Lozano-Isla^{1,2*}

¹.Dirección de Servicios Estratégicos Agrarios, Estación Experimental Agraria El Chira, Instituto Nacional de Innovación Agraria (INIA), Carretera Sullana—Talara Km. 1027, Piura 20120, Perú

² Facultad de Ingeniería y Ciencias Agrarias, Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas (UNTRM), Chachapoyas, Perú.

*Corresponding author: flavio.lozano@untrm.edu.pe

Supplementary Table 1. Treatment application schedule for the management of *Bactericera cockerelli*

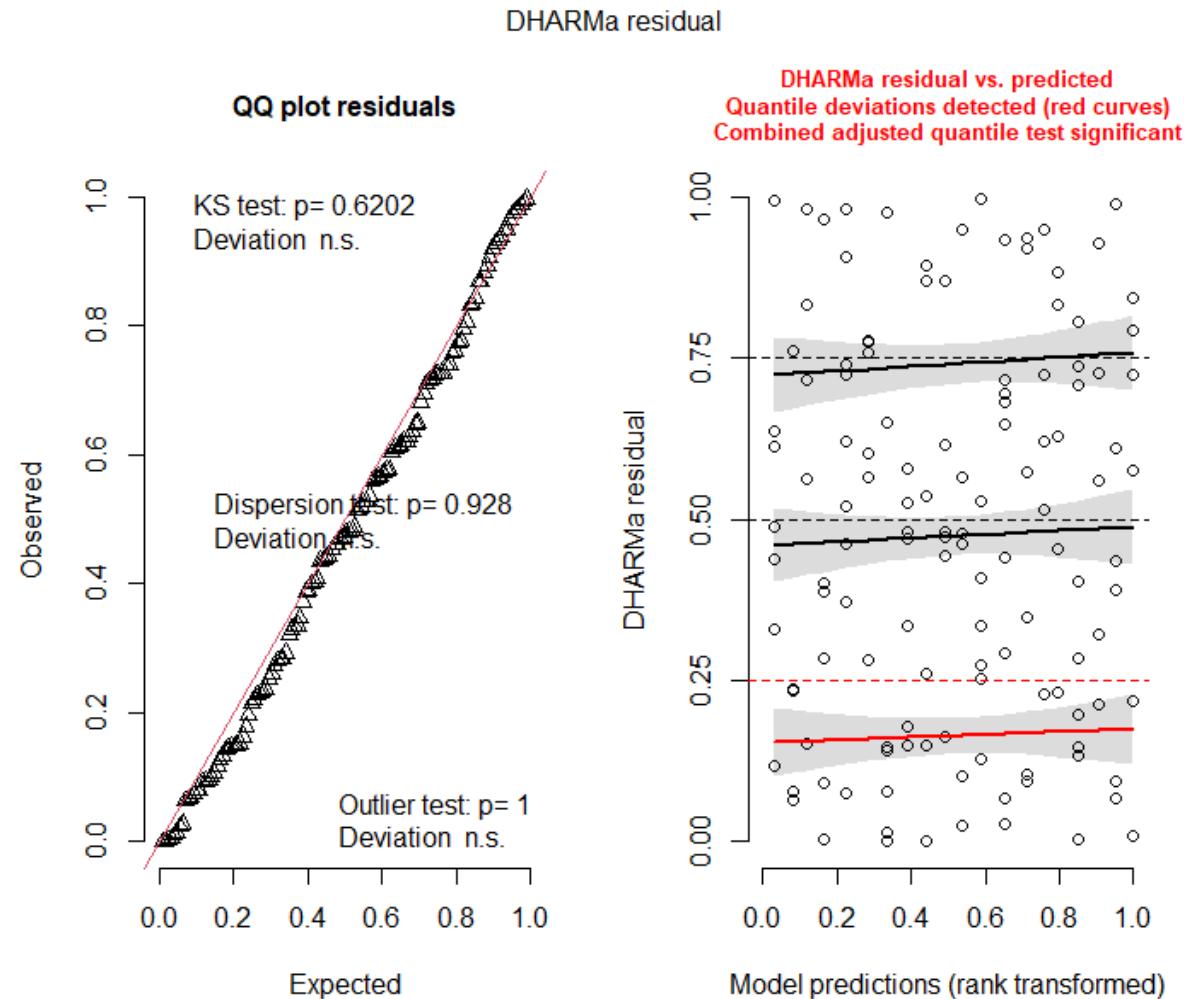
Phenological Stage	Days after planting (dds)	Application number	Treatments
Emergence	1 - 44	0	Sin aplicación
Vegetative development	45	1	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Abamectin + agricultural adjuvant + pH regulator +growth promote + Metiram + Pyraclostrobin. T2: <i>Beauveria bassiana</i> + growth promoter + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + growth promoter + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + growth promoter + agricultural adjuvant + pH regulator
	52	2	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Imidacloprid + agricultural adjuvant + pH regulator + growth promote T2: <i>Beauveria bassiana</i> + growth promoter + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + growth promoter + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + growth promoter + agricultural adjuvant + pH regulator
	59	3	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Abamectin + agricultural adjuvant + pH regulator + promotor de crecimiento + Metiram + Pyraclostrobin. T2: <i>Beauveria bassiana</i> + growth promoter + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + growth promoter + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + growth promoter + agricultural adjuvant + pH regulator
	66	4	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Imidacloprid + agricultural adjuvant + pH regulator T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
	73	5	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Abamectin + agricultural adjuvant + pH regulator + Metiram + Pyraclostrobin. T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
	80	6	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Imidacloprid + agricultural adjuvant + pH regulator T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator

Phenological Stage	Days after planting (dds)	Application number	Treatments
	87	7	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Abamectin + agricultural adjuvant + pH regulator + Metiram + Pyraclostrobin. T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
	94	8	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Imidacloprid + agricultural adjuvant + pH regulator T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
Flowering	101	9	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Abamectin + agricultural adjuvant + pH regulator + Cymoxanil (80 g/kg) + Mancozeb. T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
	108	10	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Imidacloprid + agricultural adjuvant + pH regulator T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
	115	11	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Abamectin + agricultural adjuvant + pH regulator T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator
Maturitynt	122	12	T0: Water T1: Thiamethoxam + Lambda-cyhalothrin + Imidacloprid + agricultural adjuvant + pH regulator T2: <i>Beauveria bassiana</i> + agricultural adjuvant + pH regulator T3: <i>Paecilomyces lilacinus</i> + agricultural adjuvant + pH regulator T4: <i>Metarhizium anisopliae</i> + agricultural adjuvant + pH regulator

Supplementary Table 2. Monitoring data of *Bactericera cockerelli* adults in yellow traps carried out in the study Efficacy of biological and chemical control agents against the potato psyllid (*Bactericera cockerelli* Šulc.) under field conditions in the village of Quispampa Bajo, district and province of Huancabamba-Peru, from September 2024 to February 2025.

Evaluation N°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°
Number of sticky trap	20/09/2024	27/09/2024	04/09/2024	11/09/2024	18/09/2024	25/09/2024	01/11/2024	08/11/2024	15/11/2024	23/11/2024	29/11/2024	07/12/2024	14/12/2024	20/12/2024	27/12/2024	03/01/2024
Tramp 1	28	31	22	20	8	6	6	3	3	8	8	4	8	20	5	4
Tramp 2	32	29	14	12	12	3	11	5	6	5	3	6	12	7	7	7
Tramp 3	45	51	41	24	16	14	8	10	6	9	15	8	6	8	7	2
Tramp 4	34	46	29	22	19	16	12	6	13	7	6	2	4	1	6	1
Tramp 5	12	22	25	18	14	6	12	14	4	3	8	12	2	13	6	0
Tramp 6	16	24	13	16	16	11	8	3	1	4	0	1	0	4	1	1
Tramp 7	18	10	14	8	2	7	12	11	0	3	2	0	1	2	1	0
Tramp 8	22	22	21	26	14	9	11	2	3	2	2	14	0	5	1	2
Tramp 9	45	26	12	12	4	4	7	8	2	4	0	3	1	21	1	0
Tramp 10	37	15	23	30	8	9	5	7	4	1	0	8	1	15	0	1
Tramp 11	56	16	17	28	14	9	4	2	6	5	2	5	4	7	0	2
Tramp 12	13	12	19	22	4	9	4	5	4	10	4	9	3	0	2	3
TOTAL	358	304	250	238	131	103	100	76	52	61	50	72	42	103	37	23

Supplementary Figure 1. Diagnostic Plots for Model Assumptions - DHARMA residual diagnostics for model predictions



Supplementary Figure 2. Diagnostic Plots for Model Assumptions - DHARMA-Based Nonparametric Dispersion Testing Using Residual Standard Deviations

