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Adavelt™ Active: a second generation picolinamide fungicide for use against black sigatoka disease on banana

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RESUMEN

Adavelt™ active (florylpicoxamid), es un fungicida picolinamida de segunda generación (FRAC grupo 21) de Corteva Agriscience para el control de la enfermedad Sigatoka negra (*Pseudocercospora fijiensis*) en el cultivo de banano. Adavelt™ ha sido evaluado en ensayos de campo en los principales países productores de banano en la región Mesoandina, como Ecuador, Colombia y Costa Rica. Los resultados muestran una actividad sobresaliente de Adavelt™ contra la sigatoka negra a una dosis de 25 g ai ha^{-1}, superior a los estándares comerciales. Adavelt™ ofrecerá a los productores de banano una innovadora y flexible herramienta que proporcionará un control eficaz contra la Sigatoka con una carga química inferior a los fungicidas actuales.

Palabras clave: Sigatoka negra, Banano, Adavelt™ active, fitosanidad.

ABSTRACT

Adavelt™ active (florylpicoxamid), is a second generation picolinamide fungicide (FRAC group 21) from Corteva Agriscience for control of black Sigatoka disease (*Pseudocercospora fijiensis*) in banana. Adavelt™ has been evaluated in a series of field trials which were established in major banana producing countries within the Meso-Andean region such as Ecuador, Colombia, and Costa Rica. The results show outstanding activity of Adavelt™ against black sigatoka, superior to the tested reference products at the rate of 25 g ai ha^{-1}. Adavelt™ will offer banana growers an innovative and flexible tool which provides effective control against Sigatoka disease at a use rate lower than current fungicides.

Keywords: Black sigatoka, Banana, Adavelt™ active, phytosanity.

INTRODUCTION

The control of black Sigatoka, *Pseudocercospora fijiensis* (Phylum: Ascomycetus), is one of the most complex and important tasks in the production of the banana world. Black Sigatoka is a very aggressive disease, with a high level of pathogenicity and multiple fungicide applications are required throughout the year for crop protection. Currently, only a few chemical groups are available for disease management and resistance to existing fungicides has developed causing loss of control. Therefore, fungicides with new target sites of action offering improved control are needed for effective disease management programs. It is recommended to use fungicides in mixture and in rotation with other Modes of action within a spray program to reduce the selection pressure to widely used chemical groups. The picolinamide group, with its first representative fungicide Inatreq™ active (fenpicoxamid), is the newest group of fungicides used for sigatoka control. Inatreq™ active was launched on the market approximately 4 years ago, offering effective control and a favorable toxicological and environmental profile, thus meeting the demands of the market. However, Corteva Agriscience, in its continuous search for new and better alternatives, has developed a second generation picolinamide fungicide called florylpicoxamid, with the trademark Adavelt™ active, which offers improved activity coupled with a favorable environmental and toxicological profile.

Adavelt™ active is a preventive fungicide providing translaminar movement for uniform protection. It acts by inhibiting ubiquinone reductase inside (Qil) of the mitochondrial membrane at the level of complex III, acting at the level of respiration and it has been classified into the FRAC group 21 (http://www.frac.info). Adavelt™ active shows high activity at the low use rate of 25 grams of active ingredient per hectare, which confers lower chemical load per area and reduced risk of residues in fruit. It will be marketed under the trade name Emiox™ 10SC, formulated as a 100 g ai L^{-1} SC (Suspension concentrate). It is currently in the process of registration globally and in our region in Ecuador, Colombia, Panama, Costa Rica, Guatemala and Mexico. The overall objective of the trials was to validate the efficacy of Adavelt™ active with respect to black Sigatoka in banana cultivation and to demonstrate its strengths and attributes.

MATERIALS AND METHODS

Study location. The efficacy of Adavelt™ active against black Sigatoka in banana cultivation has been evaluated for more than 8 years in a series of trials. Specifically,

this publication emphasizes ten trials established during the period 2020 - 2022, located in experimental stations in the most important banana producing areas of Costa Rica, Colombia and Ecuador (Guápiles, Urabá and Quevedo, respectively).

Description of the method (s) used. Fungicidal treatments were applied in plots or experimental units (size 144 – 225 m^2) that included 5 plants, using an experimental design of randomized complete blocks with three or four replications.

Materials and equipment. The treatments were applied using an experimental equipment based on a motor pump with a Micronair AU-8000, to ensure uniformity in coverage and droplet size, with an application volume of 19 to 23 L ha^{-1}.

Measurement parameters: The treatments evaluated included an untreated control, Adavelt™ active at 25 g ai ha^{-1} (250 mL of commercial product per hectare), Inatreq™ active at 50 g ai ha^{-1} (385 mL CP ha^{-1}) and fenpropimorph at a rate of 616 to 880 g ai ha^{-1} as a commercial reference treatment. A total of 8 consecutive applications at an interval of 8 days were conducted to evaluate the effectiveness of consecutive applications of Adavelt™ active compared to commercial references. All treatments were applied with mineral oil at the commercial dose (Costa Rica at 7 L ha^{-1}, Colombia and Ecuador at 7.57 L ha^{-1}. The trials were initiated when the plants had approximately 5 true leaves, with a similar physiological age, with average leaf emission of 7 days. Trials were established in rainy times under high disease pressure.

Analysis of the information obtained. After the applications, the percentage of infection of the treatments was evaluated, the evaluations included the leaves treated during the trial period. Five evaluations were performed at 15, 30, 45, 60 and 75 days after the first application (DDA1). The endpoint was the percentage of infection of the treatments based on the grades of the Stover Scale modified by Gauhl (1989). At the end of the applications, all evaluations were taken and the Area under the disease progress curve (AUDPC) was calculated, to see the behavior of the infection over time for each treatment. Data were submitted to analysis of variance and comparison of means using Tukey's ($\alpha = 0.05$). Additionally, the curative effect was evaluated, using a modified AFA methodology (affected foliar area, based on percentage of infection per leaf) that separates the level of initial stages of infection (S1-S4) from advanced or reproductive stages of infection (S5-S6).

RESULTS AND DISCUSSION

The incidence and severity of black Sigatoka at the time of the first application in the treated and untreated plots was "zero" or non-visible symptoms (according to Stover Scale modified by Gauhl), because we started with protection of new leaves (incubation period). The results of all the evaluations performed (15, 30, 45, 60 and 75 DDA1) and the variable of AUDPC (see Table 1), showed the same trend and evidenced the efficacy of Adavelt™ active on black Sigatoka, showing a performance equal to or better than commercial treatments, with a high pressure of the disease observed in the untreated (see Table 1). The Adavelt™ active showed very good control, with curative action at a dose of 25 g ai ha^{-1}, which confirmed its great fungicidal activity.

Table 1. Summary of ten efficacy trials including Adavelt™ active for the control of black Sigatoka in banana crop. Variable Area under disease progress curve (AUDPC).

#	Trial	Country	Year	Treatments	AUDPC	**
1	Adavelt 1	Costa Rica	2020	Adavelt 25 g ai	2000	cd
				Inatreq 50 g ai	2335	bc
				Fenpropimorph	2151	bcd
				UTD	2670	a
2	Adavelt 2	Colombia	2021	Adavelt 25 g ai	247	c
				Inatreq 50 g ai	459	b
				Fenpropimorph	343	bc
				UTD	973	a
3	Adavelt 3	Colombia	2021	Adavelt 25 g ai	354	bc
				Inatreq 50 g ai	537	b
				Fenpropimorph	304	bc
				UTD	1214	a
4	Adavelt 4	Colombia	2021	Adavelt 25 g ai	380	e
				Inatreq 50 g ai	762	bc
				Fenpropimorph	367	e
				UTD	903	a
5	Adavelt 5	Ecuador*	2021	Adavelt 25 g ai	781	ab
				Inatreq 50 g ai	831	b
				Fenpropimorph	772	ab
				UTD	1479	c
6	Adavelt 6	Ecuador*	2021	Adavelt 25 g ai	1162	f
				Inatreq 50 g ai	1361	de
				Fenpropimorph	1218	ef
				UTD	2371	a

7	Adavelt 7	Costa Rica	2021	Adavelt 25 g ai	895	bc
				Inatreq 50 g ai	1232	de
				Fenpropimorph	868	bc
				UTD	1945	a
8	Adavelt 8	Costa Rica	2021	Adavelt 25 g ai	2352	bc
				Inatreq 50 g ai	2458	de
				Fenpropimorph	2303	bc
				UTD	3062	a
9	Adavelt 9	Ecuador*	2022	Adavelt 25 g ai	1354	e
				Inatreq 50 g ai	1602	d
				Fenpropimorph	1315	e
				UTD	3158	a
10	Adavelt 10	Colombia	2022	Adavelt 25 g ai	154	c
				Inatreq 50 g ai	342	bc
				Fenpropimorph	156	c
				UTD	1006	a

* For table 1 and figure 1, Fenpropimorph doses for Ecuador 880 g ai ha^{-1}. ** For table 1 and figure 1 treatment means followed by the same letter do not differ statistically (P > 0.05).

In summary, the plots treated with Adavelt™ active at 25 g ai ha^{-1} (250 mL CP ha^{-1}) showed excellent performance and consistency compared to Inatreq™ active and fenpropimorph for control of black sigatoka in banana cultivation.

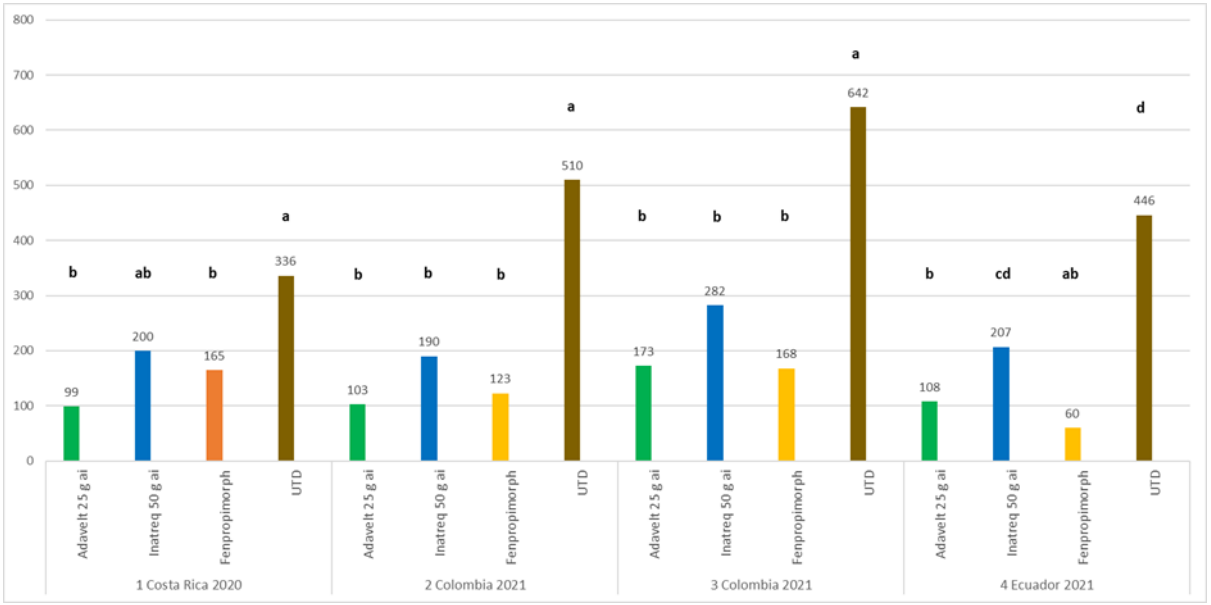

Figure 1. Summary of four efficacy trials including Adavelt™ active for the control of black Sigatoka in banana crop. Variable: AFA, curative level (Infection index: S5-S6).

Figure 2. Banana experimental site

Figure 3. Experimental plots

Figure 4. Untreated

Figure 5. Adavelt™ active efficacy

CONCLUSIONS

According to the results obtained, it is recommended to use Adavelt™ active at a dose of 25 g ai ha^{-1} (250 mL CP ha^{-1}) for the control of black Sigatoka within a commercial program, at an application interval of 8 days. Adavelt™ active will have an excellent fit in disease management programs for bananas in rotation with other registered Modes of Action (MoA's). As a new effective rotation partner for the control of black Sigatoka in bananas, Adavelt™ active will help producers to control the disease with limited risk of residues in fruit and with low chemical load.

A maximum of three applications per year is recommended and preferably in mixture with a multi-site fungicide, or another fungicide providing effective disease control.

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