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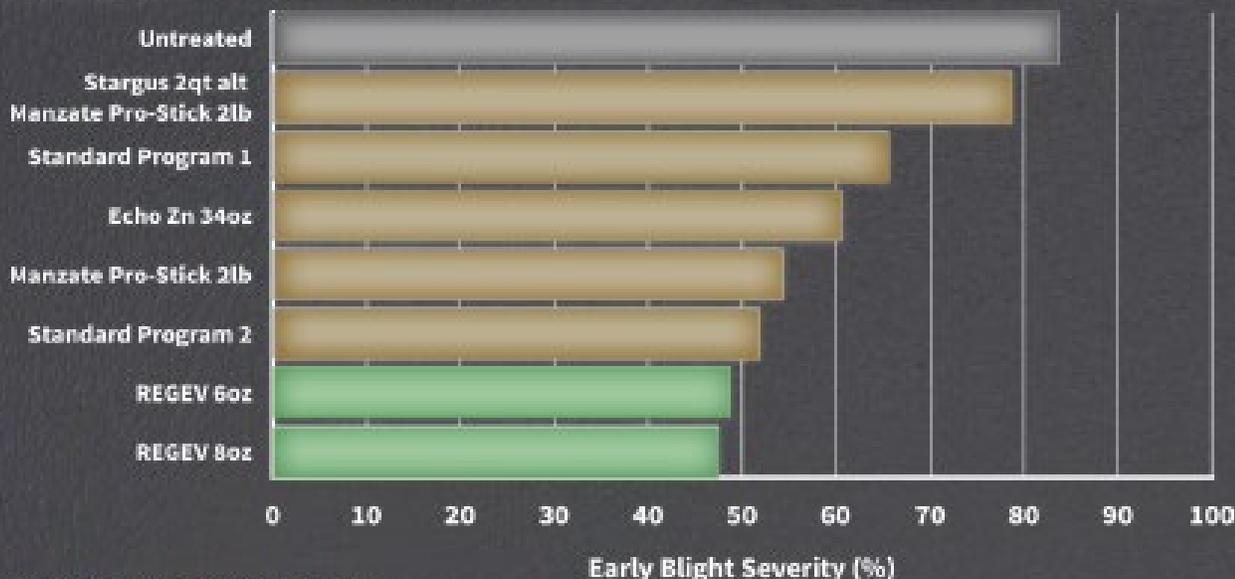
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We develop products that help farmers
increase their productivity, with high quality
and no residues.


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REGEV HYBRID FUNGICIDE WINS THE FIGHT AGAINST EARLY BLIGHT



*Julie Pascher | Inlet, ND | 2000 | 10 Applications
 Program 1 = Stargus 2qt (1-3); Echo Zn 34oz (4,5,8,10); Manzate Pro-Stick 2lb (6,7,9)
 Program 2 = Echo Zn 34oz (1,3,4,6,8-10); Quadrate Star + Manzate Pro-Stick 2lb (2); Luner Tranquility 12.2oz + Manzate Pro-Stick 2lb (5); Scala 7oz + Manzate Pro-Stick 2lb (7)*

Recent trial results demonstrate REGEV® hybrid fungicide delivers remarkable control of Early Blight in potatoes. And that's just one example of its efficacy.

REGEV is the first fungicide to unite the disease control power of botanical and conventional chemistries. This truly innovative combination provides growers multiple modes of action to control devastating diseases in potatoes, fruits, vegetables and soybeans, while enhancing plant growth and yield.

To learn more and find your local distributor see STK-AG.COM



REGEV®



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Regev™ – A Broad-Spectrum Hybrid Fungicide for Disease Control



Dr. Moshe Reuveni
Chief Scientist of STK
bio-ag technologies, Israel

Introduction

The global search for plant-protection solutions that are both environmentally safe and effectiveness is driven by the need to supply food to the ever-growing world population. The call for chemical load reduction is an important aspect for sustainable agriculture. Recently, documented issues of widespread environmental contamination, toxicity to non-target organisms and negative effects on human health by synthetic agrochemicals have led to a resurgence of interest in 'natural' means of pest and pathogen control, including intensified searches for new sources of biopesticides and botanical pesticides. The latest solutions are generally used in crop protection and contain secondary metabolites, which can be (but not always) involved in plant defense mechanisms. Among the latest solutions, the essential oils are considered to be attractive for plant protection.

Tea tree oil (TTO) is a valuable essential oil extracted by steam distillation of *Melaleuca alternifolia* (belonging to family Myrtaceae) leaves. It contains many components of terpenes, sesquiterpenes, and their respective alcohol. The oil has been shown to be an effective antiseptic, antifungal and bactericide. In the recent decade it was found to be effective against a broad range of plant-pathogenic fungi in numerous crops, including vegetables, herbs, coffee, rice, grapevines, bananas, and fruit trees.

New effective alternatives that can provide different and multiple modes of action with a lower risk for fungicide resistance, and which place a smaller chemical load on the environment concomitantly with consistent disease control, are required to increase options for the control of plant diseases. The newly developed fungicide Regev™ EC (STK Bio-Ag Technologies, Petah Tikva, Israel), a hybrid formulation containing 200 g/L of the systemic triazole fungicide difenoconazole plus 400 g/L of TTO, is a unique prepacked formulation which provides various mechanisms

of action against broad-spectrum of plant pathogens and improved efficacy. The suggested hybrid solution can be the 'bridge' between conventional agrochemical farming and sustainable farming. That's because it is a 'pre-mix', so it is easy-to-use, in the exact same way as the grower's current chemical pesticide. To the best of our knowledge, this is the first bio and chemical-based hybrid product in the industry.

Modes of action

The fungicidal and antimicrobial activities of TTO against fungal pathogens, as documented in the literature, are derived from its ability to inhibit respiration and disrupt the permeability barrier presented by the membrane structures of living organisms. Our recent studies showed that TTO had a moderate effect against spore germination and significantly inhibited lesion development and sporulation of fungal pathogen. TTO was found to disrupt the fungal cell membrane and cell wall in plant tissue infected with pathogenic fungi, which explains why it exhibited strong curative activity against fungal pathogens, making it a unique product and enabling growers to use it even when the disease is already visible on the tissue. In addition, TTO was found to be an activator of plant itself defense mechanisms and systemically induced resistance in plants.

(I would use photomicroscopy of disease cell being ruptured here, which I have and will include.)

The sterol biosynthesis inhibitors, including difenoconazole, affect the fungal cell membrane by inhibiting C-14 demethylation of lanosterol or 24-methylenedihydrolanosterol, a biosynthesis step that occurs during conversion of lanosterol to ergosterol, the final product of fungal cell membrane sterol synthesis.

The different modes of action of TTO and difenoconazole, i.e. a combination of a natural product with broad-spectrum activity (TTO) and a traditional site-specific chemical, makes Regev

an effective and unique tool for resistance management which is suitable for Integrated Pest Management (IPM) programs. This combination results in a reduced synthetic chemical load on the environment compared to other mixtures based on two traditional chemicals.

Field trials

Regev is currently used for controlling a broad range of diseases on arable crops, cereals, fruits crops and vegetables. Diseases effectively controlled by Regev include powdery mildews, apple scab (*Venturia inaequalis*), Black Sigatoka (*Mycosphaerella fijiensis*) in banana, species of *Alternaria*, *Cercospora*, *Botrytis*, *Rhizoctonia*, *Pyricularia*, *Helminthosporium*, *Sclerotium* and more. Numerous trials have been conducted with various crops in different countries. Here we present an example of Regev activity against black Sigatoka (*Mycosphaerella fijiensis*) in banana.

In a field trials in Colombia, efficacy of Regev applied alone was compared to systemic fungicides, each applied in tank mixture with a protectant fungicide mancozeb. Untreated banana plants served as controls. Four foliar sprays of each fungicide/mixture were applied at spray volume of 19 L/ha at 10 days intervals. The results given in Figs. 1 and 2 show that systemic fungicides tank mixed with mancozeb reduced disease severity as expressed by percentage of infected leaf area compare to untreated control plants. However, Regev (TTO+difenoconazole) was significantly more effective in controlling black Sigatoka.

Resistance management. Regev has a unique multiple functional activity and presents a lower probability for resistance development or cross-resistance in plant pathogens, so it could be an important tool in preventing development of cross-resistance during the season. Its application can be rotated with products that exhibit differing modes of action and to which populations of fungal pathogens have shown a loss of sensitivity, so that population of pathogens less sensitive to chemical products can be reduced.

Registration

Regev is already registered in Israel, Philippines, Serbia, United States and various Latin American countries for various crops and diseases. It is currently in the process of registration in Brazil, Mexico and the EU.

Summary

The different modes of action of TTO and difenoconazole, created by a combination of a natural product (TTO) with broad-spectrum activity, make Regev an effective and unique tool for resistance management. It presents multiple modes of action (FRAC Groups F7 and G1) to help prevent the development of resistance. This combination results in a

reduced chemical load on the environment compared to other mixtures based on two traditional chemicals, leading to reduced residues in food.

The preventive and curative activity of Regev, related to its efficiency of contact, mesosystemic plus systemic activity by a single application, together with the indirect activity via the host plant by systemic resistance, leaving little residue and providing significant added value to growers, make Regev an important component in plant disease control. Regev has an expanded spectrum over either component alone and has demonstrated activity on a wide range of plant diseases. It can therefore be an effective and easy-to-use 'bridge' solution for controlling various diseases.

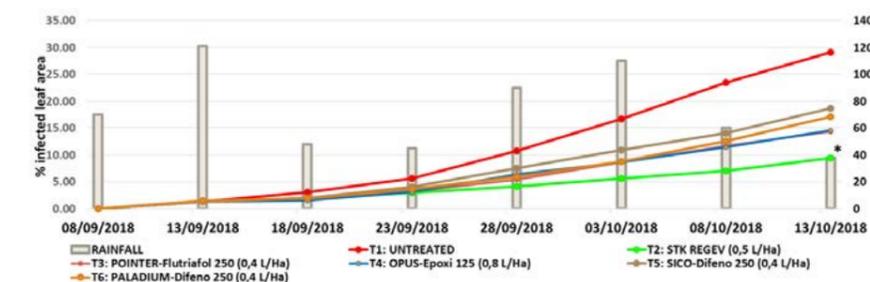


Figure 1. Efficacy of Regev (TT+Difenoconazole) applied alone and systemic fungicides each plus mancozeb in controlling of black Sigatoka in banana plantation. Star on bar indicates significant difference ($P < 0.05$).

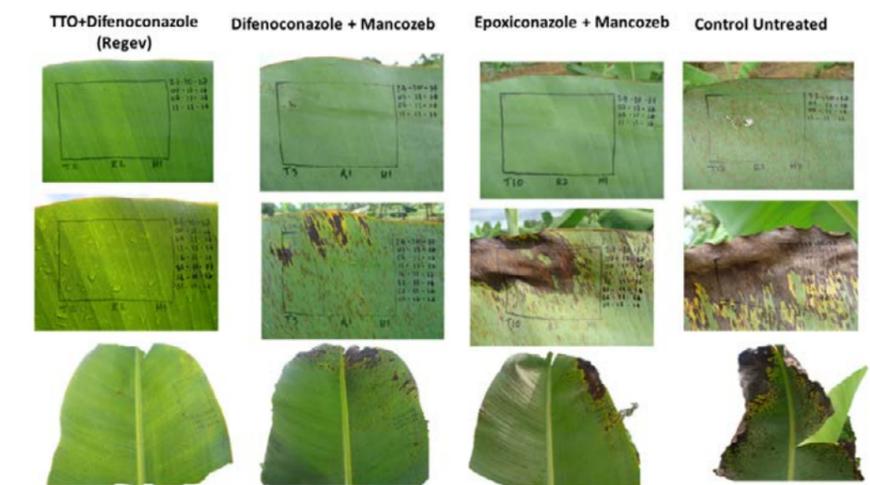


Figure 2. Efficacy of Regev (TT+Difenoconazole) applied alone and systemic fungicides each plus mancozeb in controlling of black Sigatoka in banana plantation.