

Organic botanical biocides based on tea tree oil: Safe for the environment and people

This relatively new family of biopesticides shows promise for the future and is already used alone and in combination with chemical treatments



While tea tree oil is one of the two major ingredients in Regev, a biopesticide from STK Bio-Ag Technologies, it is now available as the sole ingredient in a botanically derived and certified organic product named Timorex Gold. When combined with a conventional chemical treatment, the two combined ingredients put a stop to most fungi, bacteria and plant diseases. Source: STK Bio-Ag Technologies

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Wayne Labs

Tea tree oil (TTO), a substance also known as melaleuca oil, comes from the Australian tea tree (belonging to the Myrtaceae family) and has been used by humans to treat acne, athlete's foot, lice, nail fungus and insect bites. More likely than not, you can find it in several over-the-counter skin care products and essential oils at your local drug store and Amazon. TTO has been used as a traditional medicine by Australian Aborigines for centuries, and the substance has a variety of natural ingredients that have been shown to kill certain bacteria, viruses and fungi. ¹

One bio-ag company located in Tel Aviv, Israel has been investigating the usefulness of TTO for use as an organic botanical compound to fight fungi and other plant diseases in crops, and especially on fruit such as grapes and citrus. STK Bio-ag Technologies has developed a product called Timorex[®] Act, which is a purely organic formulation based on TTO—certified by OMRI and Ecocert—and highly effective against a broad spectrum of plant diseases in a variety of fruit and vegetable crops, including anthracnose, powdery mildew, early blight, botrytis, cencicilla, etc.

Timorex Act is also friendly to pollinators, such as bees, and has been endorsed by the Xerces Society of Invertebrate Conservation in its latest report. Moreover, the botanical biopesticide has no chemical residues whatsoever. “This activity is a huge benefit to organic growers since there are not many products available to growers looking for biological certified products without compromising efficacy, as proven by the numerous trials performed in Mexico and in the USA,” says Marco Tulio, STK country manager in Mexico.

The product has also been registered in the United States, including California and Florida, with distribution by Summit Agro. Registration efforts are also ongoing in various Latin American countries and in the EU.



Yair Nativ, STK Bio-Ag Technologies VP sales

Obviously, a biocide that is environmentally safe and doesn't hang around long after it's been applied before harvest—so fruit is safe for human consumption—has merit. I spoke with Yair Nativ, STK VP sales, to understand what this product's usefulness and limitations are. If you're making a food or beverage product that needs to have organic ingredients, then sourcing organic produce that has been grown to organic standards is crucial—and to consumers who only want to buy fresh, organic fruit, which has been grown without damaging the environment.

Why use a TTO-based biopesticide?

“Tea tree oil was established by Professor Moshe Reuveni, chief scientist, STK, as a fungicide for crops,” says Yair Nativ. “He heard that it was used in Australia by the Aborigines for fungus on the body. He tried to put a science behind it and figured it could be applied as a fungicide for crops.”

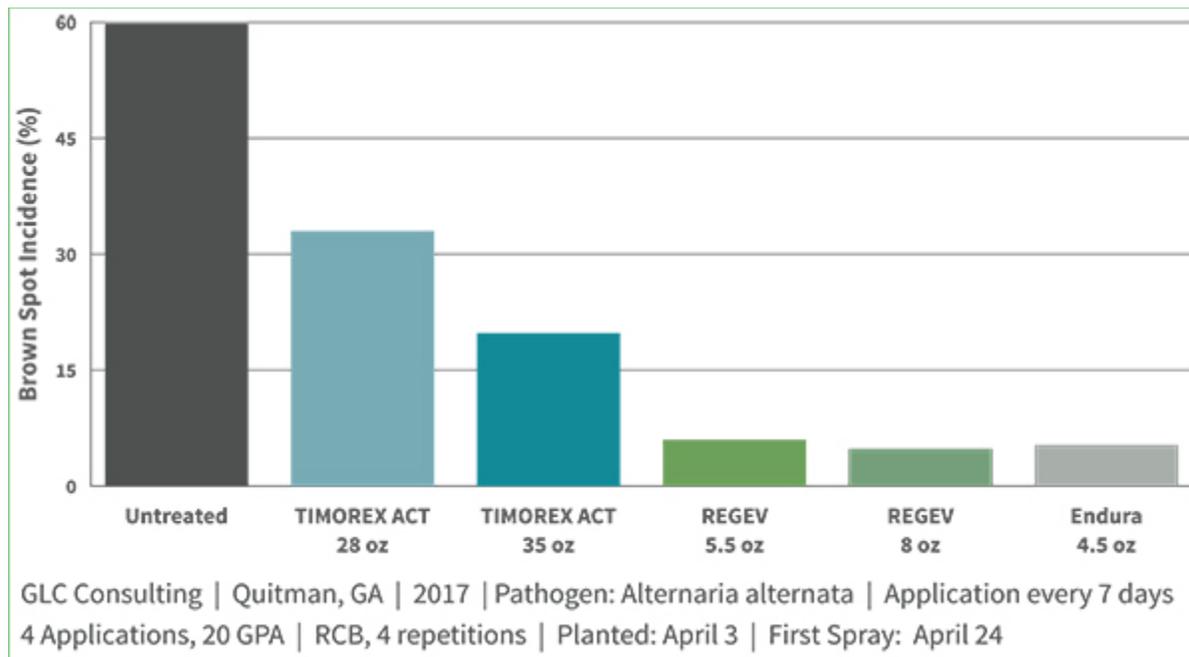
If you’ve ever grown grapes, you know they’re susceptible to fungus and mildews, especially in a wet growing season. “We have a couple of fungi attacking grapes and other crops,” says Nativ. “In order to stop plant diseases, you have to use chemicals, but we’re bringing one alternative. The TTO in the Timorex will do the same job with no residues. What we see around the world is that people will use it as the last spray. If you need to spray with chemicals, you have to do it three weeks before the harvest, but if you need to spray a week before the harvest, you will go for our product, because of the safety.”

Is spraying once before harvest sufficient? “It really depends on the area, especially the weather and the crop,” says Nativ. “In some places you have to spray two to three times during the crop life cycle, and an example would be bananas. In some parts of the world, they’re spraying bananas every 5 to 7 days. It depends on the crop and the disease. If it’s dry, it’s a different situation.”

Biopesticide is a bridge to the future of all organic

Unfortunately, using only a botanical biopesticide today can be problematic for three reasons; by itself, it may not offer the total control a grower needs; many farmers and growers are unfamiliar with its application techniques and don’t understand how to use it; and it tends to be more expensive than traditional chemical biocides, which aren’t considered organic.

Because not all plant diseases respond to TTO alone, STK came up with a hybrid solution—Regev—a combination of the botanical (which is sold separately as Timorex) and a chemical biopesticide. “One of the problems with only the botanical is that it’s sometimes hard for the farmers to adapt it,” says Nativ. They already know how to use chemicals, which kill everything—and it’s easy to understand how to apply it. But when you come to the botanical or organic products, a lot of the time you need more information on when to apply it, how to use it—and sometimes the control won’t be 100%, says Nativ.



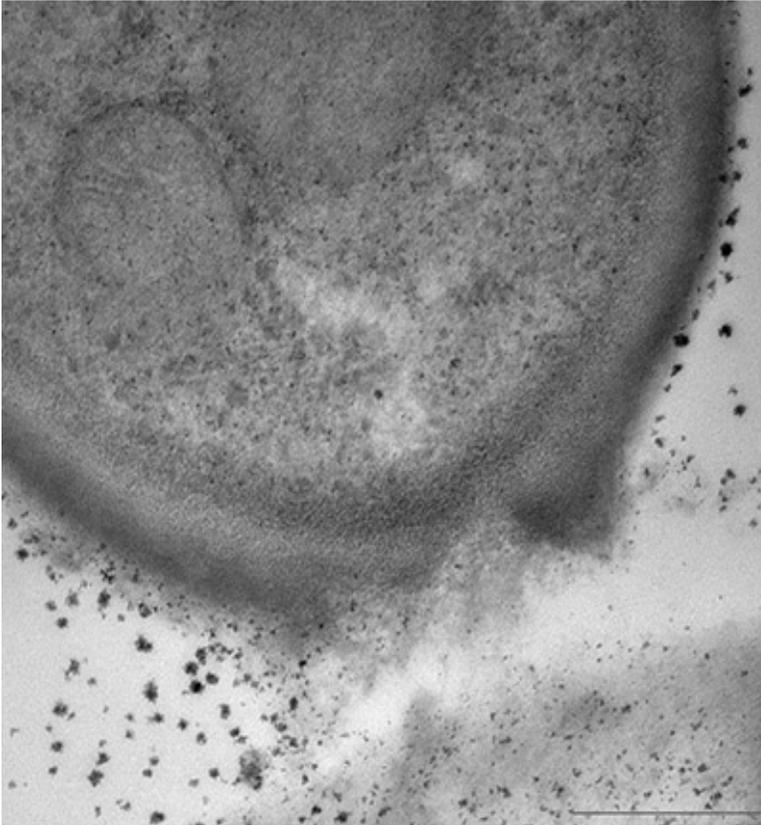
In treating brown spot incidence on plants, combined chemical and botanical solutions such as Regev will decrease the occurrence of spotting better than just a botanical alone, for example, Timorex ACT. Source: STK Bio-Ag Technologies

And the botanical solution may only be 85 to 90% effective in just one application—so it’s harder for farmers to understand how to adopt and use it, says Nativ. Growers need to be more patient with the botanical product, but its prices tend to be higher. “We came out Regev, which is a combination of the two—chemical and botanical—which controls plant pathogens by 100%.” Nativ says that Regev often replaces other inorganic products that contain two or more active chemical ingredients in them. The goal is to have a product containing only one active inorganic chemical in it for now, says Nativ.

“We did this as a bridge to the future, because in the future we do believe that everyone will use organic or botanical products, but the future is far away,” says Nativ. “It will take 20-30 years at least. In the meantime, what we’re trying to do is find a solution that will lower the impact of chemicals on the crops, residue in the environment. For us, it’s a great milestone on the way.”

I asked Nativ if it’s possible in the lab to create synthetically a product that has the capabilities that TTO has. “No chance. The oily plants have a lot of active ingredients inside. So it’s not only one active ingredient that you are taking, it’s a suite of chemicals inside—all of which of course are natural and coming from the TTO. We could take one of the active ingredients and reproduce it in the lab. But it’s not TTO. If you take one ingredient from soup, it’s not like the full soup recipe where ingredients work together to produce a single product. It’s impossible to do it in the lab—far too complex.”

Using a TTO-based biopesticide



Regev, containing both a chemical and botanical biopesticide, breaks down the cell wall of fungi. Source: STK Bio-Ag Technologies

While TTO is great as a topical application in humans, most health agencies warn that it is not for internal use. Therefore, I asked what the half-life of a TTO-based biopesticide application on fruit is. “There are two answers,” says Nativ. “According to regulation or according to the chemistry.” The chemistry will be from about 2 hrs to 12 hours. The fungicide kills the fungus cells by destructing the membrane.” When it penetrates the cell membrane itself, it helps with plant immunity and activates enzymes and hormones in the plant to help it protect itself. It induces resistance of the plant to fungal and insects as well. Once it penetrates inside the plant, it helps the plant fight along the way other fungal infections.

Regulations are more tricky. Originally, Timorex Gold was being sold in the USA, but recently changed into another product called Timorex Act, because one of Gold’s constituents wasn’t recognized organic by OMRI, however, it was recognized as organic in Europe and other countries. So Timorex Act has only TTO, and is sold in the USA and certified organic by OMRI.

Regev, which contains chemical and botanical ingredients is being used in Florida for tomatoes because it’s such a big market, says Nativ. Regev has been certified by the U.S. EPA and is rolling out now.

“If you’re buying grapes from outside the USA, probably they are coming from Chile or South Africa, and a lot of them will be treated with Timorex Gold with TTO,” says Nativ. The farmers apply it just before the harvest, and the fruit lasts longer because of the Timorex Gold. It’s antibacterial and a fungicide.

For more information, visit [STK bio-ag technologies](#)

About TTO as presented by Chief Scientist Dr. Moshe Reuveni, STK bio-ag technologies, Israel

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.

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.

Regev, a hybrid chemical and botanical biopesticide

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™, a hybrid formulation containing 200 g/L of the systemic triazole fungicide difenoconazole plus 400 g/L of TTO, is a prepackaged formulation that 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.

Regev is currently used for controlling a broad range of diseases on arable crops, cereals, fruit 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.

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.