

Citrus Oil Herbicides Gain 'Top' Organic Certification

Although EPA views citrus oil products as conventional herbicides, rather than biopesticides, a new registrant has successfully obtained organic certifications for its consumer and professional products with a novel formulation - with an ag product soon to follow.

The most recent certification of a citrus oil herbicide as "organic" is a major development for the consumer and professional markets – and there's an agricultural formulation to follow – says a consultant representing the registrant, Cutting Edge Formulations, Inc.

The Organic Materials Review Institute (OMRI) listed the company's citrus oil herbicides as organic on May 15. The products, known as Nature's Avenger, were previously cleared by the USDA National Organic Program and the Washington Department of Agriculture's Organic Food Program.

The OMRI listing was "the last big hurdle" standing in the way of full acceptance by "the organic community," Cutting Edge CEO Joe Jankauskas said May 15. "Most in the organic gardening and growing community will only use [OMRI-listed] products."

Cutting Edge obtained EPA registrations for the Nature's Avenger ready-to-use (RTU) formulation, and a concentrate, in August 2006. The products are aimed at the consumer and professional markets; an agricultural product, GreenMatch, is awaiting a registration from EPA's Office of Pesticide Programs.

However, it is OPP's Registration Division (RD) – not its Biopesticides and Pollution Prevention Division (BPPD) – which has purview over these herbicides because BPPD doesn't view their active ingredient (d-limonene) as a biochemical.

But, the "decision tree" followed by BPPD to decide against a biochemical classification won't make much, or any, difference to consumers and organic growers, says consultant Olav Messerschmidt.

That's because the OMRI certification, along with the efficacy of the products, are the attributes that count for consumers and organic growers, says Messerschmidt – formerly Executive Director of the Biopesticide Industry Alliance (BPIA) and now president of OMC Ag Consulting (East Lansing, Mich.).

Messerschmidt, who is managing the registration process for Cutting Edge products, asserts that limonene – which has long been used in numerous consumer products and food additives – equals or exceeds the performance of conventional as well as organic, non-selective herbicides. And that performance, he adds, will be the key selling point for organic farmers – who rely heavily on hand labor to rid their fields of weeds (see "An Insider Look at Organic Weed Control," Vol. 3, No. 13, July 4, 2006).

“This is the first organic herbicide that works,” Messerschmidt stated. “There have been several on the market, but, frankly, at the grower level, they’re not used very much. So, citrus oil is going to give the organic growers a tool that they haven’t had before.”

MOA

In its herbicidal application, citrus oil has a simple mechanism of action (MOA). Limonene is a strong surfactant that attacks cuticles – the waxy coatings which prevent plants from drying out. Other herbicides also attack cuticles, albeit less effectively than limonene, Messerschmidt says; so, why hasn’t citrus oil been used in herbicides before?

Because, he points out, the volatility of limonene (which accounts for the fragrance associated with citrus) prevents it from remaining on foliage long enough to dissolve the cuticle.

“It’s a wonderful degreasing agent, and that’s why you see it in so many detergents and soap,” Messerschmidt told *Insider*. “There are several papers in the literature on limonene as a potential herbicide, but when you look at those papers, I would say they rate it as a fairly weak herbicide, and the problem is its volatility. Citrus oil is 92% to 97% limonene, but it doesn’t stay on the leaf surface long enough.

“So,” Messerschmidt continued, “Cutting Edge worked on ways to ‘trap’ the limonene so it stays on the leaf surface longer, and the formulations they developed resulted in the Nature’s Avenger formulation and, subsequently, the GreenMatch formulation.”

(Editor’s note: For more background on the development of the formulations, see “Jankauskas Profile,” this issue.)

“Now,” Messerschmidt added, “although it’s a non-selective herbicide, some plants are more sensitive to it than others, and environmental factors affect its performance, to some extent. For example, when it’s warm and humid, and plants are growing very quickly, they would have a thinner cuticle, and Nature’s Avenger would be much more effective in those circumstances.”

The efficacy of the product, Messerschmidt said, is visible within “a few hours in normal, 70 degree temperature. But, on really hot days, it’s not unusual to see the plant wilting within 15 to 30 minutes.”

TESTING

Asked about the sites and research leaders for the efficacy testing (which was funded in most, but not all, cases by Cutting Edge), Messerschmidt said, “The tests were run all over the country. There were tests right here, at Michigan State, by Donald Penner. There were some at N.C. State, by Fred Yelverton. There were many trials out at UC-Davis – probably 15 – led by Tom Lanini, and it’s being tested now in Florida by [ag consultant] Bob Johnson for the IR-4.”

“This is the first organic herbicide that works.” Olav Messerschmidt, Consultant

The testing included the application of conventional materials, to allow for side-by-side comparisons, although Messerschmidt declined to discuss the performance of the conventional products beyond saying “the standard, non-selective herbicides don’t act as fast as Nature’s Avenger.”

He added, “We also tested against the leading, ‘natural’ products – the acetic acid products’ – but I should point out that those products are not organic. A lot of people are confused about that, because they assume the acetic acid products are derived from vinegar.

“They’re not,” Messerschmidt continued. “Vinegar is, at most, 5% to 6% acetic acid; the rest is water. It’s okay at that percentage, but not very effective against tougher weeds. The leading, acetic acid herbicide is much more concentrated – ranging from 10% to 25% – and there is no way you’ll derive that concentration from vinegar, so you have to use synthetic acetic acid – which precludes an organic certification.”

PELARGONIC ACID

Pelargonic acid is another, naturally occurring compound with herbicidal potential. But, like vinegar, “its presence in nature is very small, and there is no way to commercially produce it without making it synthetically, and therefore it doesn’t have a clearance from the National Organic Program,” Messerschmidt said.

Michael Braverman, Manager of the Biopesticides Program at the IR-4, told *Insider* that Scythe herbicide contains pelargonic acid, which is a short-chain fatty acid effective against grasses and broadleaf weeds. Pelargonic acid, which is also registered for use as an apple-blossom thinner, is a fast-acting membrane disruptor.

Pelargonic acid has been approved by FDA as a food additive, and is classified by BPPD as a biochemical. Braverman noted that “all these new, fast-acting formulations of Roundup [glyphosate] have pelargonic acid in them.”

Straight glyphosate is effective over a period of seven to 14 days; the addition of pelargonic acid is said to speed up its action to a period of two-to-five days. Nature’s Avenger, which is touted to be effective within a day, or hours, does not have a residual effect because of its volatility – which prevents its translocation into roots.

“There are times,” Messerschmidt said, “when [Nature’s Avenger] does get past the cuticle and disrupts cell membranes, but it won’t translocate into the root zone. Now, if you apply Nature’s Avenger to plants with small root zones, like annuals or grasses, it will kill those roots because, without a top, those types of plants will die. But, it won’t kill the roots of perennial plants, like dandelions. It will just kill the tops and the plant will come back because the roots don’t die.”

“Vinegar is, at most, 5% to 6% acetic acid; the rest is water. It’s okay at that percentage, but not very effective against tougher weeds.” *Olav Messerschmidt, Consultant*

THE NON-AG USES

The two Nature's Avenger products, Messerschmidt said, "are exactly the same except that the RTU has water added to it, and it's sold in a spray bottle – mainly for the consumer market. Consumers are buying some of the concentrate, but it's mostly bought by landscapers – and we're selling a fair amount for institutional uses – spraying around hospitals and office buildings, and so forth. It could also be used by golf courses."

THE AG USES

Once registered, GreenMatch will only be sold as a concentrate to be mixed with water. Messerschmidt says "the primary agricultural use for this product will be around trees and vines; for instance, around peach trees. A grower can mechanically cultivate and till the soil to get rid of the weeds in rows, but he can't cultivate near the trees because he might damage their roots or he might damage their bark. On average, the acres that can't be tilled amount to 20% of the total acreage [of an orchard, for example], and it's that 20% where GreenMatch would be sprayed.

"You might use it in the rows in special situations," Messerschmidt adds, "as spot treatments for weeds you couldn't get rid of otherwise. But, it will be too expensive for broadcast applications."

Messerschmidt estimates that, on a broadcast basis, GreenMatch would cost about \$300 an acre to apply. But, he points out, "no one will be spraying the entire acre. If they're spraying 20% of the acre, then we're talking about \$60 per acre."

To allow its use on food crops, Messerschmidt has sent RD a request for a tolerance exemption for GreenMatch.

BPPD CRITERIA

Asked if limonene could potentially be used for aquatic weeds, Messerschmidt said, "Possibly, but the problem is that the hurdles standing in the way of registrations for aquatic use are very high – and we have a lot of other priority markets we want to focus on."

In its limonene Reregistration Eligibility Decision, which was issued in 1994 (and which is available at www.epa.gov/oppsrrd1/REDS/3083.pdf), OPP says human exposure to the substance through the diet, soaps, perfumes, insect repellents and the other products in which it's used is not a concern. The RED also notes that FDA classifies limonene in its Generally Recognized as Safe category for food additives.


Why, then, doesn't limonene qualify as a biochemical? "Because," says Messerschmidt, "in order to receive a biochemical classification from BPPD, you have to meet specific criteria, and one of those is a 'nontoxic mode of action.' But, EPA says limonene is 'practically nontoxic [or slightly toxic to birds, fish and invertebrates]' in its [Tolerance Reassessment Eligibility Decision, or TRED."

EPA's Tolerance Reassessment Eligibility Decision, or TRED, is available at:
www.epa.gov/oppsrrd1/REDS/limonene_tred.pdf.

Messerschmidt questions the BPPD decision against granting a biochemical classification to limonene, and adds, "They've registered acetic acid as an herbicide, and it's strange, to me, that a product with a similar mode of action is considered nontoxic. This [inconsistency] has been an issue that BPIA has been very concerned about."

Asked if, in his opinion, the removal of plant cuticles qualifies as a toxic mode of action, IR-4's Braverman said, "If we were talking about insects, the answer would probably be 'no,' because the disruption of insect cuticles is certainly an acceptable MOA for many biochemicals."

Because Braverman, as a biochemical specialist, has not worked with the registration of any limonene products, he would not venture to say if limonene was, in his opinion, toxic or nontoxic for purposes of a biochemical classification.

"It depends," he said, "on the pest you're trying to control, and EPA's interpretation of the information you're submitting on the mechanism of action against the target pest. I'm not saying I agree or disagree with the [BPPD] interpretation of the limonene information because I don't know what their interpretation is." 

A paper on the BPPD classification process is posted on the IR-4 web site. It was authored by Russell Jones, a BPPD Biologist and Chair of the Biochemical Classification Committee, and is available at <http://ir4.rutgers.edu/biopesticides/RWP/RJones-Bio CI Com.htm>.

A PESTICIDE.NET Profile of Entrepreneur Joe Jankauskas

Joe Jankauskas was just trying to help his son's local landscaping business, but ended up with an effective herbicide made from citrus oil. He's now ready for prime time after obtaining a registration from EPA and certification for organic use.

Joe Jankauskas, CEO of Cutting Edge Formulations, Inc., wasn't thinking nationally when he started working on his citrus oil herbicide.

"My son wanted to start a landscaping business here, in Georgia, and he asked if I would back him," Jankauskas recalls. "I helped him out and we started the business. But, over the next seven years, I kept hearing complaints about the chemicals we were using.

"So," Jankauskas continued, "I decided to see what we could come up with as an alternative. But, I wasn't thinking about launching a national product or anything like that. I thought we'd have a little niche for it, here."

"Here" is Buford, Ga. – about 30 miles northeast of Atlanta. By the time he started the landscaping business, Jankauskas – who is originally from northeast Pennsylvania – was already an accomplished entrepreneur. He started a construction business after high school, sold that company, and eventually started a business fabricating cabinet doors out of MDF (medium density fiberboard).

“That business was very successful because we figured out a way to produce those doors with a high end finish,” Jankauskas says. “Water-based finishes really raise the fibers, so you spend an awful lot of time sanding and re-sanding the doors.

“So,” Jankauskas continued, “we worked with a chemist at a Canadian company to come up with a water-based finish that worked well on MDF, and, once we became successful, I sold the company.”

The work on a special paint for MDF doors was just a hint of what was to come for Jankauskas, who doesn't have any background in formulation chemistry.

He first heard about the use of orange oil as an herbicide while listening to a Texas radio show hosted by Howard Garrett – a.k.a., “The Dirt Doctor.” Garrett is a landscape architect who touts organic and natural landscaping, and “I had heard him talking about spraying orange oil, which I later learned was straight limonene,” Jankauskas says.

“I also checked the Web,” he adds, “and I found out that someone in Florida had been selling an orange oil herbicide in Florida, back in the early '70's, but the product wasn't registered and EPA shut him down.”

Jankauskas also learned of consultant Olav Messerschmidt during his Web browsing, and eventually enlisted his help for the both the registration process and formulation development.

(Messerschmidt, in turn, enlisted the help of Donald Penner, a Weed Science professor at Michigan State University's College of Agriculture and Natural Resources.)

“You have to emulsify limonene because it's so volatile,” Jankauskas points out. “Limonene dissipates into CO₂ real quickly – and that's why it won't translocate into soil or roots. What we tried to do with emulsifiers is slow that process down so we could keep it on the plant to burn a little longer, and that was the trick that took us two years to figure out.

“It was just trial and error,” Jankauskas continues, “and, to this very day, we are still battling that separation [of the emulsion], and that's why we have a ‘Shake Well’ statement on our container.

“We are limited in what we can use for emulsifiers because they have to be on [EPA's List of minimally toxic inerts] to keep the product qualified for organic certification, so it was real tricky. I'd make up a batch, here, and, if it worked, I'd send it on to Michigan. If it didn't work as well, up there, we'd change the formulation a little, with Dr. Penner's help. We tested each one of the emulsifiers separately, and tracked their activity, so it was a matter of finding the right ranges for a hot product.

“What we use,” Jankauskas adds, “and how much we use of it is our secret.”

“It was just trial and error, and, to this very day, we are still battling that separation [of the emulsion], and that's why we have a ‘Shake Well’ statement on our container.” Joe Jankauskas, CEO, Cutting Edge Formulations, Inc.

Jankauskus also points out that it was the long process of sending sample batches to Michigan that led “to the other basis for our patent, which is a limonene ‘enhancement.’ I was mixing up samples with Georgia water, and they seemed to work fine, down here. But, then, when I sent the samples up to Michigan, they’d tell me they weren’t working, as well. We eventually figured out the water in Georgia was more alkaline, so, during blending, we raise the pH of the formulation into the 8-to-9 range – which is perfect for limonene because it’ll burn [plant cuticles] faster. By itself, limonene has a pH of 6.

“From what I understand,” Jankauskas reflects, “I think we now know more about limonene than just about anybody else in the world.”

Cutting Edge started shipping product (Nature’s Avenger ready-to-use and a concentrate) in January. Currently, the company has registrations in 15 states (all of them east of the Mississippi).

“We’re in about 200 stores in Florida, and we’re in all of the nurseries up in New England,” Jankauskas says. “We know it’s going to take a lot of dollars to raise public awareness of our products, but we don’t think that’ll be the case with the [organic] growers [once an EPA registration and tolerance exemption is granted for the agricultural limonene product]. We think they’ll start buying the instant they hear about it. But, consumer marketing will require much more effort, and, being a small company, we’re really limited in what we can spend on marketing – especially when we have all the other state registrations as a priority. Plus, I am constantly – *constantly* – working on the formula. And, then they tell me I have to go out and raise money.

“But, it’s been fun,” Jankauskas says. “Everything, now, is ‘green green green.’ And, I’m almost there with something everybody is asking for. That part gets me a little excited. It’s been put to me that we’re riding the top of a 50-foot wave.”

Asked if he’s thought about riding a different wave if Cutting Edge achieves the success he has in mind, Jankauskas replies, “No, I don’t think so. This is my last hurrah.”

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Publisher’s Statement

PESTICIDE.NET Insider eJournal

ISSN 1553-8672

Published by:

Regulatory Compliance Systems, LLC
P.O. Box 1909
Manassas, VA 20108-1909
U.S.A.
Phone: +1-703-330-8882

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