Fumigants & Pheromones

Issue 107
Summer 2013
Routing:

EPA Award Winner
Best of the Best

A Newsletter for the Insect Control & Pest Management Industry, est. 1981

Fumigation Season 2013

By Jeff Waggoner,
FSS General Manager

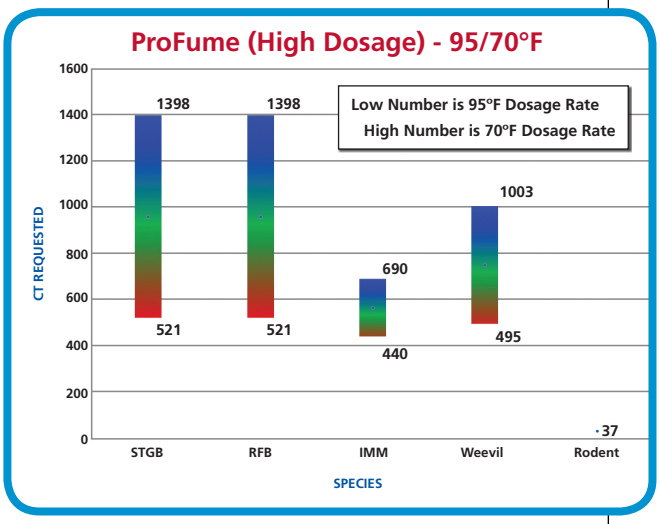
It's difficult to remember a spring and summer weather pattern that rivals what we have experienced in 2013. On the heels of the hottest year on record, I find myself waiting to experience the 100 degree days. The rainfall has pushed back planting and even caused re-planting in some areas where consecutive days of heavy rainfall have caused flooding damage. This pushes back seed returns to production sites and has delayed the fumigation plans of many by several weeks. Wheat harvest was also delayed in the Midwest. On the brighter side, there is no one experiencing drought conditions in the FSS coverage area and many crops look great by comparison, including our FSS company garden.

The company's green garden creates camaraderie and fresh vegetables.

Fumigations protect valuable stored products from insect and rodent damage. There is a distinct difference between the two main fumigants used to protect grain and structures. The fumigant of choice for structures is ProFume Gas Fumigant from Dow AgroScience. ProFume is a non-corrosive alternative to phosphine to which many have transitioned since its approval in 2004.

As stated, there are distinct dosage differences in controlling insects versus controlling rodents and, furthermore, the dosage recommendations for ProFume may differ from species to species on the insect rates. The rodent rate is unaffected by temperature. Rodents are warm- blooded and respire similar to humans, but we are the weaker species when it comes to the toxicity of fumigants. Rodents require a 37 CT (Concentration x Time) to achieve 100% control.

Insects, however, may require up to 40 X more fumigant to control certain pest species eggs, even at the higher temperature ranges.



As shown in graph, there are distinct dosage rates for several stored product pests. The primary pests targeted during stored product fumigations are typically the Indian meal moth *(Plodia interpunctella)* and the rice weevil *(Sitophilus oryzae)*. Temperature has a big impact on the amount of fumigant required to

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Mission Statement

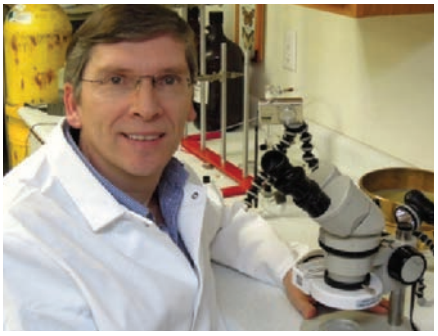
Our aim is to strive for quality service, provide the absolute best products available worldwide, to be a respected world-class organization, and maintain profitability with innovation, alternatives, and education.

Bad Bugs...

Tribolium castaneum / T. confusum

Flour Beetle

PHOTO CREDIT KANSASBUGS.ORG



By Alain VanRyckeghem, BCE
Technical Director

The red and confused flour beetles *(Tribolium castaneum and T. confusum)* are beetles that have a long life as an adult beetle. Typically they can live 6–12 months and sometimes longer. Because of this biology they produce a pheromone called an aggregation pheromone. They do not produce a sex pheromone like stored food moths.

Stored food moths only live for a few days to a week or so. As a result, the use of a sex pheromone is important. Males will respond to female very quickly and will fly long distances to follow the pheromone trail. Typically, monitoring traps can be set 25–50 feet apart and still detect the presence of moths within that area.

The flour beetles, however, do not have a strong attraction to the aggregation pheromone. They live long enough that they can encounter another male or female beetle during its random wandering in search for food. They are mostly food oriented rather than solely motivated by pheromones.

The distance of attraction for flour beetles to a pheromone trap is greatly reduced. Typically the range of attraction for flour beetles to a trap is less than 10 feet. It will rarely be caught on traps further than this distance from an infested food source. If pallets are stored above ground and the traps are below on the floor, these traps will not attract the beetles. In fact, because the beetle is happily feeding on a high quality food product (like flour or milk powder) it may not be attracted to a trap that is within 3 feet of the source. This makes flour beetles one of the most difficult stored food pests to detect and monitor.

Flour beetles will enter into packages with defects; it cannot penetrate into intact packaging (with the exception of very thin paper). Once they have entered the package, reproduction will occur with a cycle being completed in about 30 days at 90°F. Red flour beetles have optimum development temperatures about 5°F higher than confused flour beetles. Females can lay 200–400 eggs over a period of 2 months. This infestation will continue to produce new generations until at some point the package is overcrowded and food becomes limited. The beetles then produce another pheromone called benzoquinones that repel each other (anti-aggregation) and direct beetles to leave the package.

It is only after product is heavily infested (several months) that we may discover their activity. It is during this time the beetles are exiting infested products that they may become caught in shrink wrap. This is a good spot to use flashlight inspections of pallets to discover infestations that cannot be picked up by pheromone traps. When beetles are wandering around floors they can be in search of food and pheromone to direct them to new food sources. This is when the traps become useful. The detection range of food odors is limited to perhaps 15–20 feet. Sanitation within the warehouse is an important factor as the spilled foods or crevices with food product will compete with pheromone traps on the floor reducing their trapping ability. These spilled foods can be a source of infestations for other products in the warehouse.

Flour beetle traps should be 'targeted' toward these potential patches of available food. A grid system of flour beetle traps is an expensive and inefficient use of this type of device due to the short range of attraction. **The percentage of the population that is actually in the adult form is about 10% at any given time.** Repeated lab tests show that traps placed within 2 feet of a food and harborage site typically attract 10-25 % of the adult beetles present. At best a trapping system in a facility is sampling about 2% of the total population so this can give you an estimate of the infestation level for that area.

Dave's Soapbox

...for what it's worth

by David Mueller

Pesticides have been a large target since DDT was removed in the United States by the then new EPA in 1972. The next targets became such insecticides as chlordane, heptachlor and malathion. These wide spectrum and long lasting pesticides helped control pests and public health for many years. Liquid fumigants were removed from the marketplace in the mid '80s. The day that methyl bromide was listed as a controlled substance in over 190 countries, the next target became phosphine. The issue, phosphine resistance, is much different than the removal of methyl bromide by The Montreal Protocol, an international treaty signed to protect the ozone layer in the atmosphere that has no country boundaries.

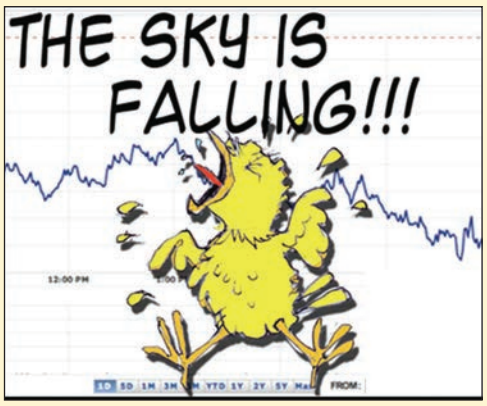
This issue, resistance, being discussed now is about managing a useful and environmentally friendly molecule that protects food and stored products.

Many know phosphine as Phostoxin™ or Weevilcide.™ This solid formulation of pellets and tablets has been used since the 1950s to eradicate insect pests in grain, seed, and structures. I personally have worked with it since 1975 and my father Albert, since 1962. During my career in fumigation I can say that phosphine is a very predictable gas and a safe fumigant that leaves little residues on food, has a strong odor for detection, is a great penetrating gas, and is inexpensive. It moves readily in and out of packaged bags of product and deep into grain bins.

Research funding is an interesting topic. Australia has studied phosphine resistance for over 30 years. Resistance has been creeping into the genome of certain select stored product beetles and weevils. Mutations in insects started occurring the first time insects were subjected to phosphine over 50 years ago.

Researchers are funded for their science and research into current and future topics of interest. Some researchers receive more funding than others. Like the business world, the cream rises to the top. Phosphine resistance is a very fundable topic in 2013. Large dollar grants are presently being applied for in a very competitive university research world.

If you look long enough you will find insects that don't succumb to a fumigant. Many times it is not the fumigant's fault but the fumigator's fault. Perhaps bad weather with strong winds causes the fumigant to dilute to a point of ineffectiveness. The wrong dosage rate could have been used, poor sealing, duration of the fumigation was too short, or the temperatures surrounding the insects were too low to affect a kill. Cold temperature fumigations cause many failures with fumigants each year. There are many variables that occur during a fumigation that can affect its success or failure.



That is why professional fumigators monitor their fumigations for effective gas concentrations and don't throw in "magic beans" and come back later to find live insects. Fumigators should make sure that the real reason for a failure was not a faulty fumigation.

With phosphine now under siege we must step back and ask why. Is it because phosphine has all of a sudden lost the battle of effective control?

Or is it that we are using this as an opportunity to make a profit with our new "Magic Beans"?

Phosphine is a great fumigant. It can be managed with great success. The dosage rate can be increased to kill those insects with weak resistance to phosphine. It should be used in combinations with IPM best practices to offer a resistance management program that could keep phosphine on the market for decades to come.

Before we all jump up and down and shout "The sky is falling!!! The sky is falling!!!", let's take a hard look at the percentage of stored product insects that are not resistant to phosphine and dial in the best programs available to those insects that are resistant and at what level. Then let's put our energies into retaining the use of this valuable fumigant for years to come. I believe that should be our focus.

The key is to collect insect samples before a fumigation including one or more of the main resistant species

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Build Your Own Fumigant Scrubber

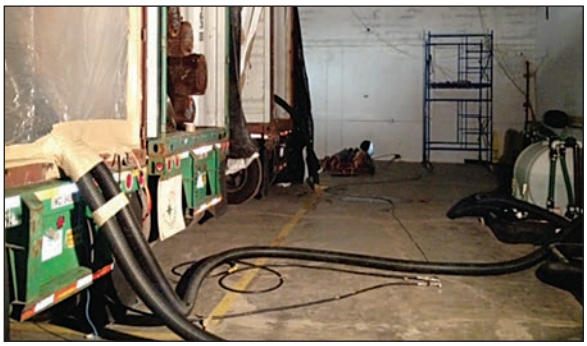
Instructors: Pete Swords, Pat Kelley, Alain VanRyckeghem, David Mueller

December 13, Friday

The Insects Limited F.A.S.T. fumigation scrubber is a liquid abatement system that takes fumigants and chemically breaks them down into non-hazardous by-products before releasing them into the environment. This new fumigant scrubber technology was invented by chemist Pete Swords of Insects Limited. He will conduct his popular "Build Your Own Scrubber" workshop on Friday, December 13. This class is hands-on and will guide you in building and maintaining your own scrubber. Instructors will explain the chemical breakdown of various fumigants, safety procedures and disposal requirements, and how to build and repair your own fumigant scrubber. Your scrubber can be shipped directly to your business.

Workshop Fees: $3000.
(Limited to 15, lunch provided)

To register, go to
www.insectslimited.com
or call **1.317.896.9300**



(above) Pete Swords, pheromone chemist for Insects Limited, has improved the F.A.S.T. fumigant scrubber used to destroy fumigants and improve bystander safety.

(left) Containers loaded with walnut logs are being fumigated before they are exported. Any remaining fumigant is being destroyed with the scrubber on the right.

Dave's Soapbox

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or after a fumigation failure. Run a simple 20 minute resistance field test or a 20 hour laboratory test to check for resistance. Testing can determine the correct phosphine dosage or alternative. In the field or garden, good garderners run soil samples to understand what fertilizers and nutrients you need for a successful crop. Likewise, **we need to get better at sampling for pests in order to make intelligent decisions on stored product protection.**

If we find that phosphine resistance is too high for using phosphine, then we need to rotate to a fumigant like sulfuryl fluoride for these select pests for a period of 2–3 years to kill off the resistant variety. Then afterward we can come back with a less expensive and safer phosphine.

It is our job, all of our jobs, to manage resistance in phosphine, share information and results, and become proactive but not overreact.

Thank you for listening to my opinions. I am open to your comments and questions at d.mueller@fumigationzone.com or 1.317.896.9300

The Potential Alternatives to Phosphine:

- Sulfuryl fluoride (ProFume) fumigant at about 2 to 3 cents per bushel
- Deltamethrin (Centynal™) & s-methoprene IGR(Diacon II™) grain protectants at 4.5 cents per bushel.
- Spinosad (Sensat™) grain protectant at 4.5 cents per bushel.

D. K. Mueller

Dave Mueller

WORKSHOPS

Insects Limited

"Sharing through Education"

Fumigation Workshops

Fumigation is a highly skilled and potentially risky business. Initial training for licensing, continued education for re-certification, a two day hands-on fumigation in the field to hone new skills from experienced fumigators, and a unique "Build Your Own Scrubber Workshop" will be offered December 10-13, 2013 in Westfield, Indiana. Westfield is located 10 miles north of Indianapolis. A block of hotel rooms have been secured. This is designed to be a one day workshop, two day hands-on workshop or a four day workshop, depending on your needs.

The training staff is made up of FSS's veteran fumigators who have performed thousands of fumigations. This includes mills, warehouses, a variety of grain bins and storage facilities, export logs, and wood materials. New technologies in scrubbing gases, gas detection and monitoring, fumigant label changes and anticipated changes will be an important topic for this workshop. **Day 1** is in the classroom. The next two days participants travel to various fumigation sites to perform hands-on fumigations.

International fumigators are welcome and invitation letters to secure registration can be provided.

December 10, Tuesday

Initial Fumigation Training, Examination, Licensing

The Indiana State Chemist will be on site to provide examinations for fumigation licensing (7D). The general core examination is a prerequisite for fumigation licensing. This training will apply to most state fumigation exams.

Instructors: David Mueller, Alain VanRyckeghem, Jeff Waggoner, Todd Wilhelm, Pete Mueller, Pat Kelley, Ryan Yutzy

8:30 AM – 5:00 PM

- Start with the Insect First
- Pre-Test
- Fumigation Study Guide Review
- Principals of Fumigation
- Fumigation Safety and Compliance
- How to Read a Fumigation Label: methyl bromide, phosphine, sulfuryl fluoride
- Grain Bin Fumigation
- Structure Fumigation
- Fumigant Monitoring
- Fumigation Respiratory Equipment

Workshop Fee: $165,
($185 after November 10)

(Limited to 35, lunches provided)

December 11 & 12

Wednesday & Thursday Hands-on Fumigation Workshop

Instructors: David Mueller, Alain VanRyckeghem, Jeff Waggoner, Todd Wilhelm, Pete Mueller, Pat Kelley, Ryan Yutzy

Classroom: 8:30 AM – 12:00

- Start with the Insect First; adults, larvae, and eggs
- Regulatory Compliance for Fumigants
- Detection and Monitoring Fumigants

1:00 to 5:00 PM

- Sulfuryl Fluoride Fumigation
- Methyl Bromide Fumigation of Quarantine Logs
- Phosphine Fumigation of Grain Bins

December 12, Thursday

8:30 AM – 12:00

Fumigation Assessments

- Ways to Improve Your Fumigations
- Fumigations Case Studies; Accidents and Deaths
- Fumigation Paperwork; before, during and after

1:00 – 5:00 PM

Visit Fumigation Sites

(Limited to 20, lunch provided, no continued education credits available)

For details go to www.insectslimited.com or call 1.317.896.9300

December 13, Friday

Scrubber Workshop

Insect Movement

Understanding the movement patterns of stored-product insect pests within a food processing or storage facility is important in terms of identifying and targeting pest management at sources of infestation and determining their potential to avoid pest management tactics. In this case study, we demonstrated using a mark-recapture technique that the red flour beetle *(Tribolium castaneum)* was able to move among floors within a flour mill, but the majority (86%) of beetles was recovered on the same floor on which they were marked. For individuals that moved to a different floor, most moved downward (70%) and typically only to an adjacent floor (87%). Use of heat treatments to disinfest structures is an important pest management tool, but insects have the ability to move away from unfavorable temperatures. During a heat treatment of the mill there was an increase in the number of beetles captured, indicating increased movement, but there was not an increase in movement of marked beetles between floors. These results suggest that the rate of heating was sufficient to not allow the beetles time to move to cooler floors and escape the treatment. Results of this study indicate that red flour beetles are mobile enough that sources on other floors need to be considered in making pest management decisions.

Dr. James Campbell,
Research Entomologist

USDA: Stored Product Insect Research Unit, Center for Grain & Animal Health Research
james.campbell@ars.usda.gov
www.ars.usda.gov/npa/cgahr/spiru/campbell

Fumigation Training: Plan Now

Now is the time to plan for your continued education so your license doesn't expire. Many people wait until the last month on their license and desperately search for a way to avoid taking their fumigation examination over again. Here are various opportunities to renew your licenses, learn more about this potentially risky business of fumigation, and meet some nice people.

August 6, Kentucky Feed & Grain Association
Fumigation Continued Certification Program
Bowling Green, Kentucky. *Organized by FSS*

December 10, **Initial Fumigation Training and Examination**
Westfield, Indiana. *Organized by FSS*

December 11-12, **Hands-on Fumigation Workshop**
Westfield, Indiana. *Organized by FSS*

December 13, **Fumigation Scrubber Workshop**
Westfield, Indiana. *Organized by FSS*

January 7, 2014, **78th Purdue Pest Management Conference**
FSS among invited speakers

January 16, 2014, **Georgia Pest Control Conference**
University of Georgia, Athens, Georgia, Fumigation Continued Education.
FSS among invited speakers

March 26, 2014, **GEAPS Educational Program**
Auburn, Indiana. *Fumigation training by FSS*

June 2-4, 2014, **11th Fumigants & Pheromones Conference** Krakow, Poland. *Organized by Insects Limited and FSS, www.insectslimited.com*

FSS offers custom training at your facility or ours. Call for details.

If you are interested in attending one of these Fumigation Training conferences, call FSS at 1.317.896.9300 or email: D.Mueller@fumigationzone.com or go to www.fumigationzone.com for details.

Fumigation 2013

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achieve the desired results. Many fumigation failures occur in the spring and fall when temperatures of buildings and grain could be 50–55°F (8–10° C). While there is some degree of efficacy at these temps there is a definite impact on the efficacy percentage of immature insects at cool temperatures. The cost of the fumigant can change by threefold depending on the temperature. The ProFume Fumiguide assists the fumigator with initial dosage recommendations based on efficacy studies, species selection, half-loss time, and duration of the fumigant exposure time. Therefore, fumigant gas monitoring has become a key part of a successful fumigation.

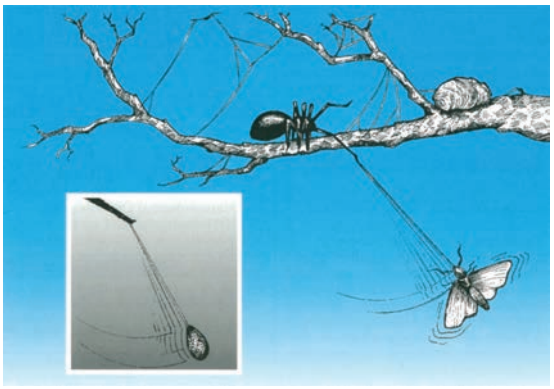
The complete life cycle of stored product pests contains four stages (egg, larva, pupa, and adult). The egg and pupa stages are typically the most difficult to control due to inactivity at these stages and slow respiratory rates. Understanding the biology of the most common target pests and discussing the options with your FSS regional representative will help you make the best decisions and achieve your goals during fumigation.

Hey Buddy, Mind if I Use Your Pheromone?

By Pat Kelley, ACE
Vice President

In the amazing world of nature, several unique species of insects and spiders actually produce or respond to the pheromones of other insects for their own benefit. This intriguing phenomenon has developed over evolutionary time within certain species that share the same living environment. Insect species that exploit the pheromones of other species are doing so because it gives them an advantage to survive. Let's look at some examples nature has provided.

Bolas spiders of the family *Aranidae* are not even true insects, but they produce the sex pheromone of *Pyralid* moths. The clever spiders attract their moth prey right to them without even having to move. Bolas spiders are incredibly adept at swinging a sticky silk blob at the end of a line of silk (bolas). When the male moths approach the pheromone scent, the spiders maneuver their bolas and rope-in the unsuspecting moth for a juicy feast. (Note: The term "bolas" comes from the age-old hunting tool used mainly in South America that incorporates two heavy weights connected by a long rope. The bolas is thrown and it entangles the feet of its large prey and brings it to the ground until the hunter can approach).



A Bolas Spider draws in a male moth with the female moth pheromone and captures it.

Butterfly larvae of the family *Lycaenidae* produce a substance that mimics the pheromone of ants that they share a home with. As the vulnerable butterfly larvae feed on edible plant leaves, approaching ants would typically look at the larva as an easy meal. Instead, the larvae produce a pheromone odor that mimics the attending ants in the colony while at the same time offering up a liquid food substance from their glands. While competing ant species look at the larvae as "dinner", the home colony views the larvae as a food source and a "brother." The butterfly larvae even have a second line of defense in their pheromone pocket. If they are attacked by an outside ant colony, the larvae produce an alarm pheromone that mimics the alarm pheromone of the home ant colony. The home colony will respond and fight the other attacking ants to the death while protecting the sly and deceitful butterfly larvae.

PHOTO: GREGORY G. AND MARY BETH DIMIJIAN

Lycaenid moth larvae produce an ant brood pheromone that makes the ants think it is one of them.

The Pine Engraver beetle, *Ips pini*, is a common bark beetle and important pest of pine trees in the Great Lakes region of North America. When a male pine engraver beetle discovers a suitable pine tree to attack, he emits an aggregation pheromone that attracts other male and female engraver beetles to that tree. Large numbers of pine engravers will gather on that single tree to mate, lay eggs and begin a new generation of engraver beetles.

PHOTO: BILL BARR

Adult Checkered beetle attacking a Pine Engraver beetle.

The checkered beetle, *Thanasimus dubius*, is a specialist predator that feeds exclusively on the insects within trees killed by bark beetles. Checkered beetles are much larger than bark beetles and they have voracious appetites. They have been said to eat several times their own weight in a single day. Checkered beetles have become so specialized in the Great Lakes region that they are strongly attracted to the aggregation pheromone that pine engraver males emit. These predators pick up the pheromone scent of the bark beetles and will fly to the tree and immediately begin feeding on the pine engravers.

These are just a few of the examples that nature gives us in the amazing world of pheromones. The next time you find yourself placing a moth pheromone lure into a sticky trap, remember that you're not too much different than the clever bolas spider drawing in her prey!

NEWSLETTER

Fumigants & Pheromones is published by Fumigation Service & Supply, Inc. and Insects Limited, Inc. We hope that the information that you receive from this newsletter will help you in your business, and you, in turn, will support our business efforts. If you have an associate who would be interested in receiving this newsletter, please contact the address below. We would welcome any comments or suggestions for topics. Address correspondence to: Peggy Rutkowski, Fumigation Service & Supply, Inc., 16950 Westfield Park Rd., Westfield, IN 46074 USA.

Insects Limited
INCORPORATED

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GreenWay

The new GreenWay Pantry Patrol trap is non-toxic, ready-to-use, long-lasting, and child and pet safe. The trap and lure combination removes stored food beetles from your pantry, kitchen, home, and business. This inexpensive pheromone-based trapping system utilizes insect pheromones mixed in natural grain oil. The food attractant is designed to lure and capture a variety of beetles and moths that infest stored food. It includes pheromones for cigarette beetle, warehouse beetle, flour beetle, and food moths. In addition, it contains a powerful food attractant for dozens of other pantry insects. For more information, visit: **www.GreenWayTraps.com**.

Proper placement of pheromone traps is important.

"Quotable Quotes"

"Insects from more than 1,900 species form parts of the diets of roughly 2 billion people worldwide. Beetles make up the majority of the insect food that is considered a delicacy by man."
— according to a study by the Food and Agriculture Organization of the United Nations

"Clear communication is critical to diffusing inaccurate assumptions."
— Jeff Waggoner, GM, Fumigation Service & Supply, Inc.

"Methyl bromide penetrated flour 10 cm in 12 hours, ProFume™ (sulfuryl fluoride) penetrates 20 cm of flour in 2 hours and 30 cm in 4 hours, phosphine fumigant can penetrate 3 meters of flour in 24 hours."
— Chris Bell, Ph.D., CSL retired