

Update

NPMA LIBRARY UPDATE

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Dehumidification as a Pest Management Tool

Several years ago, NPMA published a *Library Update* that outlined the significance of moisture and its role in decay infections and wood destroying insect infestations. (See *Library Update*, August 2001). Having established the long-standing belief that moisture plays a major role, recent research and engineering developments have shown that having a moist atmosphere in a basement or crawlspace can lead to other pests, such as carpenter ants and certain beetles. Beyond that, the mold scare has led experts to make public statements that mold growth is a direct result of moisture. While as an industry we are neither trained nor responsible for inspecting for molds as part of our normal inspections, any time customers reduce relative humidity, it follows that there will be positive effects on reducing chances of pest survival and even decay of wood members.

Role of Humidity in Stored Product Pest Management

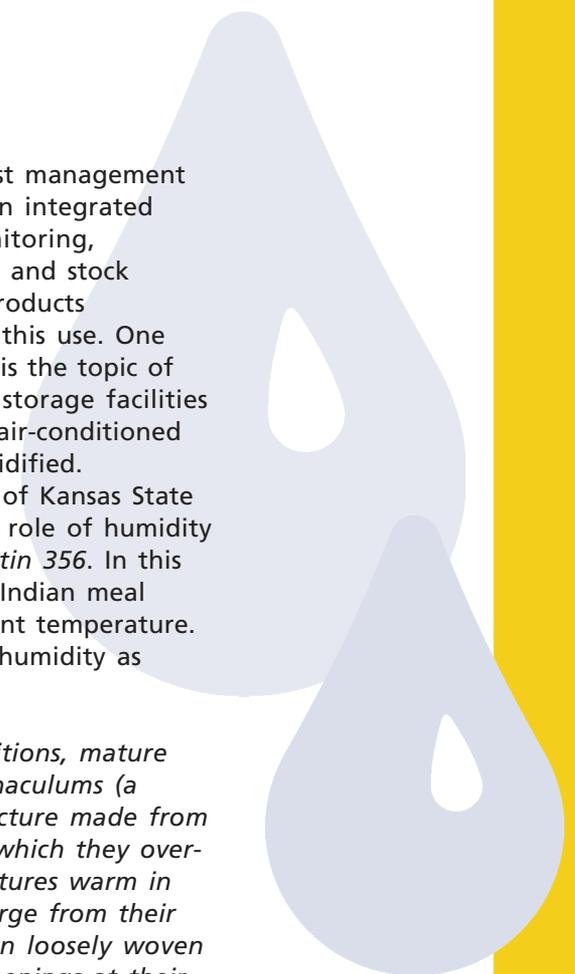
It has been widely reported that insect pests can be controlled at least in part by controlling the relative humidity of the insect environment. While choices are limited in the residential customer base, in commercial accounts, stored product pests can cause a financial disaster for customers such as restaurants and food processors.

In such accounts, pest management can frequently involve an integrated approach including monitoring, trapping, proper storage and stock rotation and applying products specifically designed for this use. One area of interest recently is the topic of dehumidification. Many storage facilities such as warehouses are air-conditioned but they are not dehumidified.

Robert Bauernfeind, of Kansas State University, addresses the role of humidity in insect control in *Bulletin 356*. In this case, he was addressing Indian meal moth success at a constant temperature. He reported on varying humidity as follows:

"Under outdoor conditions, mature larvae construct hibernaculums (a completely closed structure made from tightly woven silk) in which they overwinter. When temperatures warm in the spring, larvae emerge from their hibernaculums and spin loosely woven silken cocoons with openings at their anterior ends. Emergent moths thus begin a current season's cycle (three to five generations) of IMM.

"Under indoor conditions, where temperatures are 'comfortable,' IMM are capable of continual development. With ideal temperatures and relative humidity (86 F and 70 percent,



respectively), development from egg to adult requires three to four weeks. At 86 F and 25 percent relative humidity, developmental rates are extended (five to six weeks from egg to adult). Under controlled laboratory/insectary conditions, IMM can produce 12 generations per year. In indoor situations other than under controlled conditions, seven and eight generations per year have been reported by various authors."

G.D. Christenberry, Extension Agricultural Engineer at Clemson University reports that stored products such as grains or grain products will have an equilibrium relative humidity (ERH). ERH is essentially the relative humidity of the atmosphere at which point the product will no longer pick up or lose moisture. ERH of commodities will vary but Christenberry correlates an observation that as commodities absorb moisture, there is a greater chance of infestation.

Taking this to extremes, we know that flour products such as cake mixes will become infested more rapidly in areas of high humidity when the product has added moisture. So palatability increases for insects when the product moisture increases.

Using the example of the Indian meal moth, relative humidity not only affects the biology of the pest by direct exposure but also affects the feeding rate.

While ideal relative humidity will vary from insect to insect, typically a relative humidity below 70 percent will slow insect reproduction and adjusting the RH to less than 60 percent will have a dramatic effect.

Pest management firms can work with customers to encourage lower RH and even temperature for stored products in commercial applications. In larger accounts, temperature increases can also be effective but may be more intrusive on operations thus less acceptable to the customer. Adjusting relative humidity with minor temperature changes may accomplish the control while not incurring the cost of extreme temperature increases or decreases.

Rust and Reiersen report that extreme heat or cold will control household pests. This control method is commonly done in large accounts.

In a smaller account or in residential accounts, there are few opportunities to decrease ambient air temperature to 32 degrees Fahrenheit or to increase ambient air to 140 degrees Fahrenheit without the use of very specialized equipment. It follows that reducing temperature and humidity in the residential setting will also reduce pest populations.

Where are the Pests?

Even though reduced temperature and humidity can control insects exposed to these modified conditions, there may be populations that seem to thrive in atmospheres of reduced relative humidity in air-conditioned areas.

For example, an Indian meal moth infestation can be baffling. In a recent situation, pheromone traps were installed and the food source was removed. The maximum pantry temperature was 20 degrees Centigrade (approx. 68 degrees Fahrenheit). Relative humidity was low enough to prevent major population explosions (50-60 percent RH at the above temperature). Yet activity continued. No adults, pupae, or larvae were observed outside of the closed pantry.

After removing all products, the overhead fluorescent light was removed. Behind the light fixture, there was a major infestation. Larvae, eggs, and cast skins were found. Upon removal, the technician discovered that the fixture was attached to an electrical ceiling box. Warm, humid air could be felt pouring into the area. A quick check of the construction revealed an un-insulated ceiling with the area between the joists filled with warm, humid air, which was pouring into the protected area above the light. The Indian meal moths had their own microclimate. Only a thorough inspection revealed the problem. The lesson for the technician was that even though there are great pheromones available and other products to use to control the pest, a thorough inspection is still required and even discarding the



Surface of light that was against pantry ceiling. Note cast skins.

infested product might not be sufficient. (See pictures in this article.)

For stored product pests and many interior non-wood destroying structural pests, dehumidification will slow the biological cycle. Use of dehumidification is a reasonable alternative when other methods are not fully successful and it is not practical to freeze or heat the area to necessary levels.

Dehumidification of Crawlspace and Basements

All inspectors have been in the "horror" crawlspace with insulation hanging down and moisture dripping onto the crawl floor.

Historically, these situations were remediated by installing vents in the crawlspace walls. In fact, building codes call for at least one square foot of ventilation per 150 square feet of floor space. If the crawl has a vapor barrier, the required ventilation is one square foot of ventilation per 1,500 square feet of floor space.

Ventilation certainly serves to reduce fungus and other negative situations in the crawl during most of the year. There are times of the year when drawing in warm, humid air will be of minimal help in controlling fungus or moisture in the crawl.

Crawlspace and basements are usually cooler than the ambient outside air during much of the warm season. This is due to the area being partially underground. Also, commonly, air ducts run air conditioner lines through the area. No duct system is leak-free and some of the cooler air leaks into the area cooling the air and all other surfaces. When the warm, humid air hits these surfaces, the moisture in the air condenses and causes moisture droplets

to form. Picture a glass of cold iced tea setting on a table outside during a humid day. The cold surfaces of the glass cause condensation of the moisture in the air on the glass. Drawing warm, humid air into a crawlspace with cooler surfaces will have the same effect. Prolonged exposure to this warm humid air will lead to many wet surfaces.

What about Ventilation?

The industry has recommended ventilation for years and data suggesting that the crawlspace or basement area should be closed off to prevent condensation is only one possibility for the future and perhaps only in certain times of the year. For example, when the ambient air dries, it will serve to dry out the surfaces of the crawl. The short period of very high humidity in the crawl should not affect construction or maintenance at this point. Keep in mind ventilation is required by code and moving air will reduce chances of fungus during most of the year.

NPMA looked at one crawlspace in the southeast and recorded summertime data from inside a house, outside, and at the crawlspace floor and at the insulated joist level in a crawlspace. While data inside the house held at around 75 degrees Fahrenheit and 50 percent relative humidity, crawlspace temperature was typically 80 degrees and the RH was 80-90 percent. There was elevated moisture on the joists. Interestingly, the data showed that the



Crawlspace with excessive moisture condensing on multiple cooler surfaces.



Electronic monitoring near joist in test crawl.



Ventilation is still required by code and data sets do not suggest that ventilation habits should be changed at this point.

RH at the floor joist level was highest, probably due to condensation of onto cool surfaces near the air-conditioned sub-floor.

Data sets generated by Advanced Energy and other groups throughout the country show that there is some promise for a closed crawl or basement by tying it to a specialized dehumidification process. The ideal dehumidification system includes:

- High volume of air circulation over the coils
- Coil-freeze protection
- Pulling in outside makeup air
- Creating a positive pressure in the living space
- High capacity (typically more than 65 pints per day)

Therma-Stor of Madison, Wisconsin has developed dehumidification units for crawls and basements. While Therma-Stor also encourages the use of these products for prevention of molds and mildews, we will confine our discussion to insect control.

Dehumidification will reduce the chances of conducive conditions. At the same time, dehumidification will reduce infestations of structural insect pests such as spiders, millipedes, and camel crickets.

A crawlspace in a high moisture climate was visited after two years of dehumidification, which was installed when the house was new. There was also a vapor barrier on the interior crawl wall and no additional ventilation. Advanced Energy was conducting studies to see effects of various crawlspace attributes.

The dehumidification system was a high capacity with outside air makeup. What was striking was that the subfloor nails were perfectly shiny ... an indication that there was inadequate moisture in the air to rust the nails. Also there was a distinct lack of occasional invaders such as spiders.

EPA has several publications suggesting to homeowners that they reduce moisture in crawlspaces and basements in order to reduce pests, molds, mildew, and other maladies of crawlspaces and basements. More and more homeowners are asking about crawlspace and basement dehumidification.

The specialized dehumidification costs much more than a hardware store dehumidifier but data shows that these specialized units are much more effective. Also, as further add-ons, these units have options of micro filters and charcoal. For more information about these specialized dehumidifiers, contact Therma-Stor at 1919 Stoughton Road, P.O. Box 8050, Madison, WI 53708, www.thermastor.com, 800-533-7533.

There will probably be other manufacturers of similar products, but at this point data has only been presented by Therma-Stor.

Conclusions

Dehumidification can be a valuable tool to reduce pest populations in a structure especially where superheating or super cooling is not practical. Homeowners have begun to ask about dehumidification and our industry can provide these services as add-ons.

NPMA does not advise eliminating ventilation at this point, which violates codes, as more data must be developed; however, in certain times of the year, dehumidification may be successful in reducing moisture, which leads to conditions conducive to infestation and occasional invader activity.

NPMA will keep membership advised on data developments. ●