

# Pest Management Timing

Accurate timing of pest treatments will improve pest management effectiveness

In the milling industry, structural fumigants or heat treatments are conducted mostly on major holidays to suppress stored-product insect populations—primarily of red and confused flour beetles.

On these major holidays, the facilities are shut down, providing ample time for a whole facility treatment. This practice is normal, because mills may be operational 24 hours a day, and stopping production for pest management does not make economic sense.

However, between these holiday fumigations or treatments, insect populations continue to build. Since pest management intervention is done on specific holidays, insects have adequate time to breed.

**Whole mill treatment data.** The flour beetle data shown in Figure 1 supports this view and is based on data from sampling 19 mills in Kansas, Oklahoma, and Missouri. Therefore, a whole mill treatment is the only option to control infestations that are widespread within the mill.

The insect populations found within mills were not influenced by outdoor environmental conditions. Mills that were running eight-hour days had 77% fewer insects in December compared with numbers in August, because of biweekly cleaning out of elevator boots, followed by periodic fumigation of the mill. This trend was not apparent in mills that were running 24 hours a day.

Besides fumigation and heat treatment, other treatments include use of residual insecticides for crack/crevice or spot treatments and fogging with approved insecticides.

However, two recent studies show that accurate timing of treatments is more effective in killing insects than waiting for a holiday to perform fumigation.

## Evaluating Treatment Effectiveness

It is difficult to know all of the sites where insects are hiding and breeding. Therefore, measuring



effectiveness of any insecticide treatment is difficult with resident insect populations.

Various techniques can be used to gauge the effectiveness of any pest management intervention. For example, in the milling industry, the effectiveness of fumigants, heat, or fogging is verified by placing test cards with specific growth stages of insects in various mill locations or pieces of equipment.

Examination of tailings or milling streams for presence of insects and checking fragment counts in flour also provide an indication of treatment success. This type of sampling is not done routinely and may be time consuming, as the products have to be sifted or subjected to further laboratory analysis.

Visual inspections also can provide an estimate of treatment success. However, the accuracy of estimates may vary from person to person.

Treatment effectiveness during visual inspections can be based on the presence or absence of live insects or insect trails. The duration of effectiveness (how long a

treatment is effective) can be determined by periodic (biweekly) inspections.

Whether or not a certain intervention is better or worse is based on these observations and comparisons made over many years of experience. An example of an effective treatment, in the miller's opinion, may include the absence of live insects 30 days after an intervention.

**Traps.** Researchers generally use traps for gauging treatment effectiveness. Pest control companies that service the milling industry use traps to detect and monitor insect infestations. However, the number of traps used are too few to provide a good estimate of treatment effectiveness.

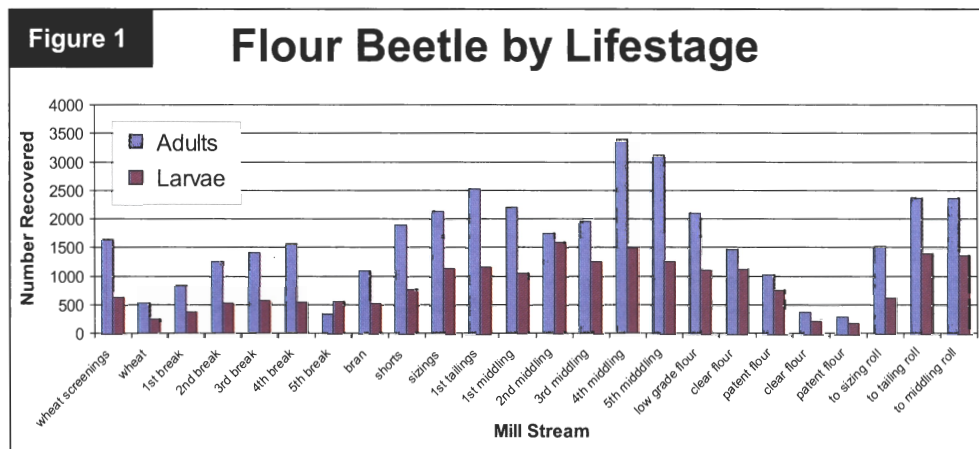
Food- and pheromone-baited commercial traps are used for crawling beetles and flying moths. Several researchers have used traps to gauge treatment effectiveness.

The effectiveness of traps in capturing insects is influenced by various factors such as insect mobility, behavior, mating status, and environmental temperature. Traps with a female sex pheromone lure (e.g., Indianmeal moth, cigarette beetle) only capture the males. Traps with aggregation pheromones (e.g., red and confused flour beetle) are not as attractive as traps with sex pheromones.

Despite these limitations, traps with food and pheromone lures are valuable tools for determining insect populations before and after fumigation, heat treatment, or fogging.

## Insect Location

Several interesting findings emerged



Source: N.E. Good. 1937. Journal of Kansas Entomological Society, vol. 10, pp. 135-148.

from the work of various scientists, when traps were used to monitor insect populations, both inside and outside mills before and after fumigation.

Dr. James Campbell and Dr. Richard Arbogast, both of U.S. Department of Agriculture (USDA), reported in 2004 on the response to fumigation of insect populations in a flour mill (*Entomologia Experimentalis et Applicata*, vol. 112 pp. 217-225).

The captures of Indianmeal moth and warehouse beetles were higher outside than inside. The captures outdoors and indoors were correlated and showed patterns that reflected seasonal weather changes.

The authors inferred that the source populations of these insects were outside and showed that insects from outside were able to enter the mill.

The captures of red flour beetles were higher inside than outside suggesting source populations to be within the mill. Red flour beetles were detected earlier in traps than in product samples, and trap captures provided a better estimate of treatment effectiveness than insect numbers in product samples.

In general, the daily capture rate of the red flour beetles in traps decreased by 88% after fumigation, which is con-

sistent with findings by other researchers using traps in mills subjected to fumigation. Another interesting finding is the timing of fumigation did not coincide with increasing populations of the pests.

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Accurate timing of treatment also will help in prolonging the effectiveness of an intervention, provided effective sanitation and exclusion practices are in place to complement insecticidal intervention.

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#### When to Administer Treatment

In a related 2006 paper, USDA scientists Dr. Micheal Toews, Dr. James Campbell, and Dr. Frank Arthur (*Journal of Stored Products Research*, vol. 42 pp. 480-498) used traps to gauge insecticidal effectiveness of fumigation and fogging. They concluded that fumigation or fog-

ging did not eliminate red flour beetle infestations.

These insects were captured during the first week of trapping after an intervention. It was unclear whether the insects captured in traps were those that survived the fumigation or those that came from outside the mill.

The authors noted that some of the treatments were unnecessary based on the presence of low insect numbers.

Furthermore, the timing of insecticide treatments did not occur when pest populations were increasing rapidly.

These limited studies strongly suggest that the milling industry should re-examine its pest management practices by understanding pest population dynamics and applying intervention at a time when populations are about to explode.

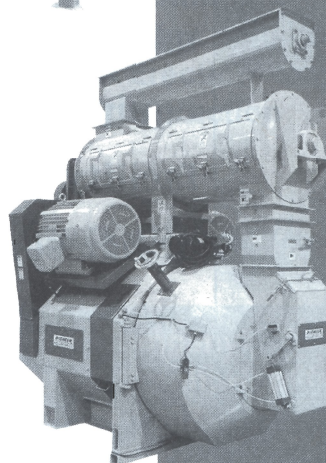
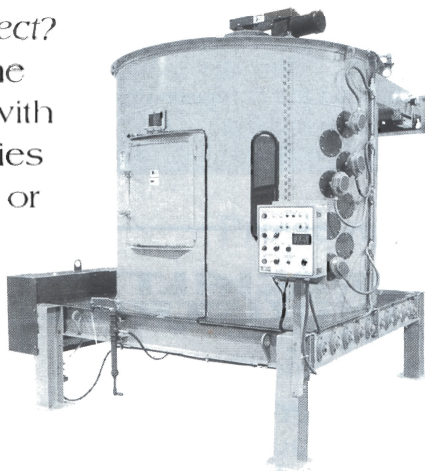
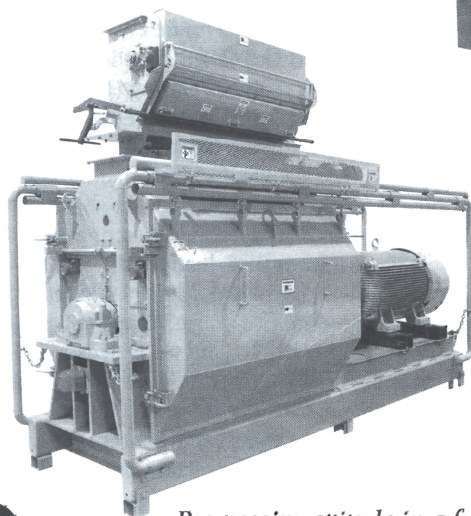
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