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Areawide Stored Grain IPM

A Tale of 2 Elevators

Much of the IPM projects' research relates in some way to grain fumigation. Can the expense of fumigation be reduced by controlling insects through sanitation or cooling? What is the best way to know if and when fumigation will be necessary? Can

insect-related risk be managed better and more cheaply by proper monitoring than by “insurance” fumigations? When fumigation is necessary, how can it be made more effective?

Figure 1 shows an effective grain fumigation. The graph shows the average insect density for 25 bins that were fumigated as wheat was moved in September. In the moving grain before fumigation, we found an average of one insect in every 1.25 kg of wheat that we sampled. After eight months of storage, although the population had rebounded somewhat, the number of insects was lower than

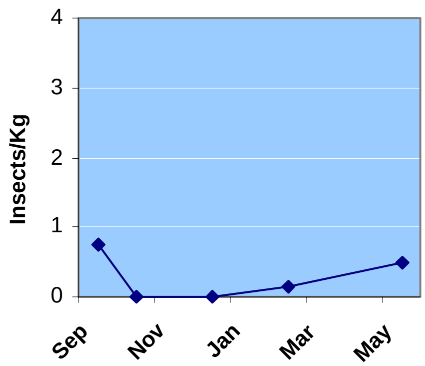

Figure 1. Bins fumigated in September 1998, Elevator #1.

before the fumigation. In May, too few insects were present to cause significant problems in most bins, and too few to be discovered by normal sampling techniques.

Fumigation does not always result in such long-term control. Figure 2 shows the recovery of insect populations after a fumigation in a different elevator. Here the insect populations recovered rapidly after an internal turn and fumigation in August.

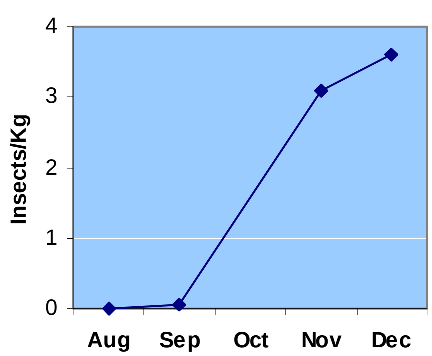

Figure 2. Bins fumigated in August, 1999, Elevator #2.

Again, each point is the average of many bins (20 in Sept, 72 in Oct, and 43 in Nov). After only three months, this grain contained an average of more than three insects per kilogram. This grain would have required fumigation again, before shipping, in order to avoid discounts. By December, many of the bins had already reached a level of insect-damaged kernels that would cause problems in marketing the grain to flour mills. The cost of maintaining the quality of the grain represented by Figure 2 was at least twice that of the other grain, and the risk of discounts was much greater.

Why the Difference?

What caused one of these fumigations to be so much more effective than the other? It was not differences in grain temperature or moisture, because these were very similar. In each case, the grain was not cooled by aeration after the fumigation. If it had been, the rate of insect population recovery would have been much lower.

Was the fumigant application method the reason for the difference? In the first example, grain was transported by truck from other elevators, and fumigant tablets were added as each load entered the storage bin. The bin vents in this elevator were also sealed. In the second example, grain was turned from one bin to another for fumigation and the bin vents were not sealed. However, in some of these bins, the fumigant was added periodically as in the first example, so the application technique was essentially the same. Nevertheless, the result was very different. By November, nearly three insects per kilogram were found in this grain, compared to none in the first example. The main difference between the two elevators is that one had not been used for several years, and probably had a very low residual insect population in residues, bin bottoms, grain moving equipment, etc. The other elevator had large insect populations that had carried over from the previous year. If this is the reason for the difference, it demonstrates the importance of sanitation to the success of fumigations.

In the second elevator, the fumigant application was changed about half-way through the fumigation cycle. Managers decided to apply the entire fumigant dose to the bottom third of the grain in order to compensate for chimney effects. This allowed researchers to compare the effectiveness of the two fumigation techniques.

Figure 3 shows the distribution of insects from power-vacuum samples taken in November, as influenced by the application technique. The insect densities are averages of 18 bins treated in the standard way and 26 bins treated by bottom application. Except for the sample taken closest to the grain surface, grain treated by the bottom application had equivalent or lower insect counts than grain treated in the standard way. In the densely-infested, surface grain, more than 75 % of the insects were rusty grain beetles, which do not cause grain damage or heating. The bottom application technique was particularly effective against weevils, but was only about equally effective against lesser grain borers. Overall, the grain treated by bottom fumigation had 8 % as many weevils as grain fumigated in the standard way.

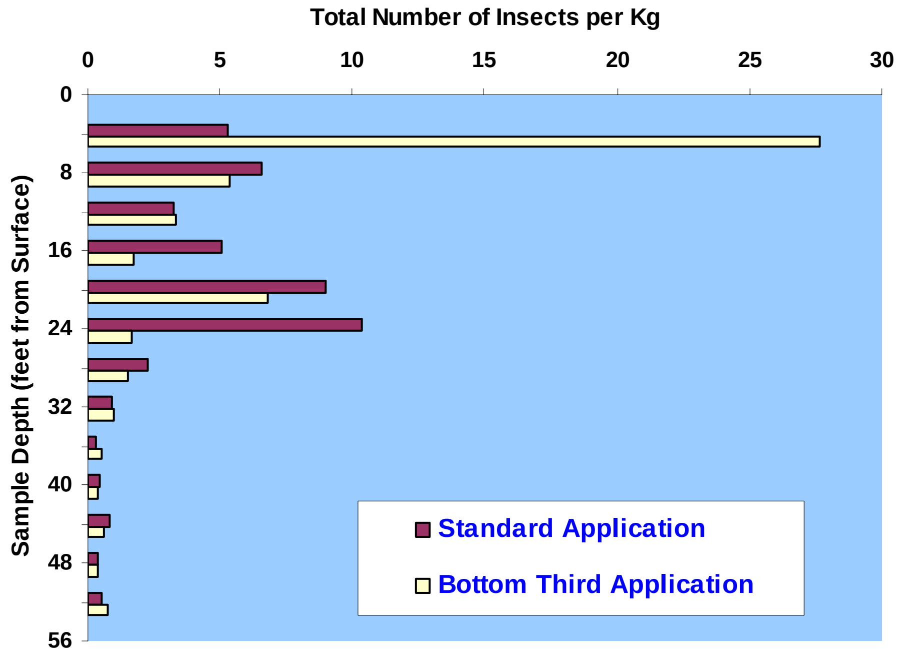

Figure 3. Effects of applying phosphine tablets in the standard method, compared with the bottom third method, on insect density in grain sampled at different depths. Note: grain was fumigated in August and sampled in November.

Conclusion

Total insect load at an elevator could be a factor in determining how soon after fumigation bins become reinfested. Elevators that carefully manage their grain may have lower “insect load”. Sampling grain to determine which bins need to be fumigated

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