Impact Machines: Experiments

This final installment of a two-part series examines past research.

In last issue, we discussed the development of Entoleter LLC's infestation destroyer. This time, we will look at other tests and experiments involving infestation destroyers.

R. T. Cotton, working in Kansas State College's (now known as KSU) Bureau of Entomology and Plant Quarantine, in cooperation with the college's Milling Department, reported his findings on the effectiveness of the Entoleter infestation destroyer at 3,500 rpm in the Association of Operative Millers' (AOM) *Technical Bulletin II* (1937-43).

In replicated trials, he fed one quart of wheat infested with 100 live rice weevil or lesser grain borer adults into an Entoleter infestation destroyer. The machine achieved a kill rate of 100%.

In subsequent tests, Cotton more than doubled the sample size of infested wheat. He infested wheat with 100 rice weevil adults, 100 lesser grain borer adults, and 100 flour beetle adults and fed the sample through the Entoleter infestation destroyer at speeds of 1,750 rpm and 2,100 rpm.

This test was replicated four times, and the results showed an average of 99.66% mortality rate for all insect species at 1,750 rpm, and a 99.58% mortality rate at 2,100 rpm.

Cotton also infested five one-quart first-break samples with 200 eggs, 200 larvae, and 200 adults of the flour beetle. At 1,750 rpm, the Entoleter produced a 100% mortality rate on all stages.

Pest Management

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In the Cleaning House

In 1951, E.D. Swanson and J.A. Shellenberger investigated the effectiveness of an infestation destroyer, scourer, and aspirator treatment process in killing and removing immature insects (eggs, one-week-old larvae, and three-week-old larvae) developing inside kernels and adult rice weevils in wheat. The results of their studies were published in AOM's *Bulletin*.

Swanson and Shellenberger found that the 14-inch peg rotor with a smooth liner was the most effective in killing all insect stages, as compared to the 13-inch blade rotor with a corrugated liner.

Only one egg survived when 50 grams of wheat were passed through the infestation destroyer/scourer/aspirator setup with the 14-inch peg rotor. Several eggs and one larvae survived using the 13-inch blade rotor. In an untreated 50-gram sample, an average of 94 insects were observed.

Fragment counts in 50-gram flour samples increased with an increase in insect age. The majority of fragments were contributed by adults, followed by three-week-old larvae and one-week-old larvae.

Fragment counts in samples that were passed through an infestation destroyer ranged from zero to 57 per 50 grams of flour. Fragment counts in samples that did not go through an infestation destroyer ranged from zero to 140 per 50 grams of flour.

Infestation Destroyer/Scourer/Aspirator

In 1951, G.C. Potter, J.A. Shellenberger, and E.P. Farrell showed that the removal of hidden infestations was most effective when infested wheat was passed through the infestation destroyer/scourer/aspirator setup followed by a corrugated pre-

break roll operated at a 2.5 to 1 differential. The overs from a 26 wire screen were then passed through a Kice aspirator.

Approximately 0.05% of the stock was removed by aspiration, but the fragment counts were reduced drastically with this system. The results of the study were published in the August 1951 issue of *American Miller and Processor*.

A.N. Hibbs and R.B. Dodds, in a 1950 AOM *Bulletin*, suggested that at 1,750 rpm, the infestation destroyer/scourer/aspirator system may be effective in removing rodent hairs and pellets.

Dodds and Hibbs recommended using two infestation destroyer/scourer/aspirator setups in a series, for maximum removal of insect fragments. In addition, these machines also contribute to cleaning by knocking loose hulls, crease dirt, wheat beards, and bee wings, which subsequently are removed by the aspirator.

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In 1961, E.A.R. Liscombe reported in his thesis at the University of Minnesota that the infestation destroyer/scourer/aspirator setup reduced insect-infested kernels by 40%, thereby reducing insect fragments and ash content.

Tests with Flour

R.T. Cotton and J.C. Frankenfeld conducted tests with patent flour and published the results in the October 1942 issue of *American Miller and Processor*.

Five one-quart samples of flour—each infested with 200 eggs, 200 larvae, and 200 adults of the flour beetle—were passed through an Entoleter infestation destroyer at 3,500 rpm and then stored for six weeks to assess insect survival.

No live insects were found in the treated samples. A separate test with 1,000 eggs, 1,000 larvae, and 1,000 adults also yielded a 100% kill rate.

Quart samples of flour were collected at six-hour intervals over a three-month period from a commercial mill in which an infestation destroyer was installed. Samples were held for six weeks after collection. Two samples contained a live adult flour beetle.

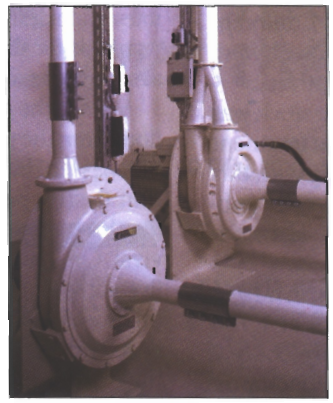
Within the same experiment, pancake flour from the packaging line of three mills was passed through the Entoleter infestation destroyer, then packaged and held for three months to examine insect survival. Only two of the 216 packages had a live adult—one was a rice weevil, and the other was a lesser grain borer. Since these species do not prefer flour, it was thought that they infested the packages from the outside.

The only other tests with flour were conducted in 1971 by R. Mills at KSU using a 2-hp, 3,450-rpm infestation destroyer, with a 14-inch, 56-peg rotor with a feed rate of 1,125 lbs. per hour.

All stages of the confused flour beetle were destroyed when infested flour was passed through the infestation destroyer.

Tests done in other countries have shown the effectiveness of infestation destroyers in destroying insect eggs in rye flour. Today, the double rotor impact machines can handle larger flour capacities and are effective in destroying eggs of insects. ▶






Infestation destroyers from left: Sturtevant, Ocrim, Buhler, and Spomax.

Conclusions

Much of the information on the effectiveness of impact machines in destroying insect life dates from 1940 to 1965, which is probably a result of a high number of incidents of mills receiving infested wheat. To my knowledge there are a limited number of studies on the effectiveness of these machines in the milling industry.

However, I was unable to find a lot of published literature in popular or scientific journals on the effectiveness of more recent models of impact machines. Companies that manufacture the machines may have internal data.

I was able to find a lot of information on the effectiveness of the early impact machines, but was unable to find more recent models. In many cases, the data had a lot of missing information, such as rotor size and rotor speed.

I assume that millers are familiar with the significant energy consumption of these units and can make assumptions as to whether these units are critical for reducing and eliminating, insect fragments in flour.

Impact machines continue to be an integral part of pest management in the flour milling industry, and there is room to conduct detailed studies on the relative contribution of the impact machines and aspirators in the overall reduction and removal of pest insects throughout the milling process.

Note: The mention of product names does not constitute an endorsement for their use by the author or KSU.

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