

EFFECT OF TOBACCO REDRYING PROCESS ON INSECT MORTALITY

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INTRODUCTION: Redrying is a process whereby the moisture content of tobacco is reduced to a level safe for long term storage without mold damage. The redrying procedures in the USA vary according to the requirements of the purchaser. Generally speaking, tobacco redried and prized for domestic storage will be prized at a moisture content of 11-12%, as compared to tobacco prized for export to the United Kingdom at a moisture content of 10-11%.

In addition to the preservation of the tobacco, redrying can also be an important method of insect control. Redried tobacco in storage is subject to insect infestation from two sources: insects which have been included in the tobacco during handling, and insects migrating from other infested areas. Utilizing the redrying of tobacco, an integral process in the industry, is a logical approach for eliminating the former source of infestation.

Green tobacco received from the growers curing barns via the sales market has an average moisture content of 16-18%. The green tobacco at the rate of 6,810 kilograms per hour is fed into the redrying machine which consists essentially of a series of drying, cooling, and ordering chambers. Table I summarizes exposure time and temperature ranges. Passage through the machine is achieved by depositing the tobacco in a carpet-like layer 9-15 cm. deep on an endless belt 2.44 meters wide. The entire machine used for these experiments is 45.72 m. long, 5.8 m. high and 3 m. wide. Moisture in the green tobacco is removed in the heating chambers where indirectly steam heated air is circulated by fans. The tobacco is then cooled in the cooling chambers, reconditioned in the ordering chambers and lastly, discharged and packed into hogsheads or cases. Hogsheads average in size 1.3 m. high by 1.3 m. in diameter. Cases average in size 1.3 m. x 0.76 m. x 0.76 m. The containers may or may not be lined with any one of a variety of materials; polyethylene, kraft paper or laminated materials. The plastic film linings are intended to inhibit moisture change of the tobacco. The tobacco density in the package is 292 kg. per cubic meter.

Currently most tobacco is redried in the form of stemmed tobacco known as "strips". Whole leaves are threshed and in this process the large mid-rib or stem is removed and the lamina is reduced to fragments of over 5 cm. square which are referred to as "strips". The stems are redried separately in specially designed redryers. For selected uses a small percentage of tobacco is redried in the form of whole leaves, utilizing a longer time cycle. In this experiment flue-cured strip tobacco was used because this process utilizes the shortest time cycle thereby providing a more severe test. Experiments conducted in 1946 demonstrated that redrying of strips destroyed most life stages of the insects infesting tobacco[1]. Tobacco processing changed considerably and further tests were conducted in 1965 which included bundle tobacco, strips, and stems[2]. Temperatures of the air spaces in the redryer were recorded in this work. Subsequently the operating cycles of redryers have since been shortened by many processors. Also a greater range of temperatures is used by many processors according to moisture requirements. Most recent research work demonstrated the variation in insect mortality according to operating cycle time and temperature[3]. During the course of this work, temperatures within the carpet of tobacco were monitored with an electronic recorder as the tobacco passed through the redryer.

TABLE 1. Mortality of Cigarette Beetle Eggs, Larvae and Adults and Tobacco Moth Larvae Exposed in Tobacco Redrying Machine.

	Exposure Area			
	Drying Section (Group 1)	Ordering Section (Group 2)	Complete Redrying (Group 3)	Drying Elevated Moisture (Group 4)
Exposure Time	3', 17"	2', 20.6"	5', 42.5"	3', 17.7"
Air Space Temp. Range	175°F-250°F	142°F-146°F	Drying 175°F-250°F Ordering 145°F-148°F	175°F-235°F
Insect Mortality	100%	100%	100%	100%

Controls -- Average Mortality of: Cigarette Beetle Eggs - 6%, Larvae - 7%, Adults - 8%, and Tobacco Moth Larvae - 0%.

We are concerned with the question of possible survival and transfer of live insects to the commodity being packaged for ultimate long term storage. The work described in this paper is intended to demonstrate the effect on insect mortality of the range of temperatures and cycle time at our processing plant. Also an attempt was made to demonstrate the comparative effectiveness of

the drying sections versus the ordering section.

METHOD: These tests were made in November and December of 1973. Test insects consisted of adult, fourth instar larvae, and eggs of the cigarette beetle, *Lasioderma serricornis* (F.) and late instar larvae of the tobacco moth *Ephestia ellutella* (Hubner). All were obtained from laboratory reared cultures. Individual cages per insect stage contained 25 adults, larvae, or one piece of tobacco stem on which approximately 25 beetle eggs had been deposited. Each cage of moths contained five larvae. The beetle adults, larvae and eggs were confined in stainless steel wire (40 mesh) cages approximately 1.9 cm. long and 0.6 cm. diameter. The moth larvae were placed in cages approximately 6.4 cm. long and 0.6 cm. diameter. Larger cages and fewer individuals were used for moth larvae exposures to reduce the possibility of cannibalism. Each exposure consisted of one cage of each stage placed in an open meshed nylon bag. Insects were examined for mortality 24, 48, and 72 hours after exposure. Three cages of each stage of each insect were used as controls.

The replications were divided into four groups of five exposures each. After exposure the insects in each cage were transferred to small petri dishes. The controls were also transferred to similar petri dishes upon completion of the exposure of the test insects.

The four groups of exposures consisted of [1] five exposures to Drying Section, average exposure time; 3 min. 17 sec., temperature range 175-250°F, [2] Ordering Section, average exposure time; 2 min. 20.6 sec., temperature range 142-146°F, average moisture content of tobacco was 10.8%, [3] Complete Redrying Process, average exposure time; 5 min. 42.5 sec., temperature range of drying section 175-250°F, of ordering section, 145-148°F, average moisture content of tobacco at discharge was 11.1%, [4] Drying Section, for this group of exposures, an effort was made to elevate the moisture level of the tobacco before introducing the insect. However this effort did not prove to be significantly effective. The average exposure time was 3 min. 17.7 sec. and the temperature range was 175-235°F.

Readings for moisture were taken with a BAT Moisture Meter at the discharge end of the redryer in groups 2 and 3.

Moisture readings from the cooling chamber ranged from 4.7-7.7%, and averaged 5.86%. These data were derived from twenty-five samples of tobacco taken from the cooling chamber at 5 min. intervals. The over-all period of sampling was simultaneous to the over-all period required for the insect exposures.

RESULTS: 100% mortality of insects occurred in the drying section and in the ordering section. Similarly 100% mortality of insects occurred when the insects were exposed to the entire redrying process. This work indicates that this combination of exposure, time period and temperature range can be 100% effective in killing the subject stages of these two insects during the redrying of tobacco.

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