COOLING TOBACCO STORAGES DURING THE WINTER SEASON FOR CONTROL OF THE CIGARETTE BEETLE

by
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At the Second International Conference on Stored-Product Entomology, we discussed procedures used to determine the thermal conductivity and specific heat of cured flue-cured tobacco leaf. Further, we outlined how these properties and physical properties of a sheet-metal tobacco storage were used to build a computer model to predict throughout the year temperature of tobacco packed in hogsheads and stored in the warehouse. Specifics of this research are given in Part I (1) of a three-part report series.

By modeling, we were able to predict the cooling requirements of a 5500-hogshead capacity storage located in North Carolina at latitude of 34°41'. Then we examined cooling systems for their applicability to chill tobacco during the winter season to 4°C or less over a period of 56 days. We found wind energy at the warehouse location insufficient to power adequately any type of cooling system. Solar cells for direct conversion of sunlight to electricity to drive vapor-compression refrigeration equipment are currently too expensive. Rankine engines driven by solar energy have poor conversion efficiency and cannot compete with electrical powered compression refrigeration equipment during the winter season. It became apparent that if solar energy was used to drive a cooling system, the collectors must operate throughout the year with the energy stored in a hot reservoir or converted into ice for storage. Because the storage to ground temperature differential is less with ice than with the hot fluid (90°C), cold storage is more efficient.

Solar-driven aqua-ammonia absorption refrigeration system: The proposed system, as illustrated in Figure 1, appeared to be technically feasible for cooling tobacco storages during the winter season for control of the cigarette beetle, *Lasioderma serricorne* (F.). By modeling we determined that 173 m^2 of double-glazed, selective surface, flat-plate solar collector area would be needed to produce enough ice annually to cool the 19,480-m^3 tobacco storage to 4°C for a period of 56 days. Solar-heated fluid in the storage tank is circulated through the generator of an aqua-ammonia absorption refrigerator, and under high pressure the gaseous fluid is condensed by means of a water cooling tower. Liquid ammonia passes through an expansion valve and changes into a gaseous state in the evaporator and then returns to the absorber where it is chilled and mixed with water before its return to the generator.