

Weight Loss in Stored Wheat Caused by Insect Feeding¹

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It is often stated that the losses in stored grain caused by insect feeding amount to at least 5 per cent of the annual production. However, so far as is known to the writer, no detailed observations have been made on the weight loss during the developmental period of those species feeding within the kernels. Therefore, in connection with an investigation to develop survey methods for determining insect losses in stored grain, observations on the actual loss of weight in wheat during the developmental period of the rice weevil, *Sitophilus oryza* (L.), were conducted under controlled conditions.

METHODS.—With a standard grain trier a sample was drawn from a bin of newly harvested wheat in farm storage. This wheat was virtually free from insects, but so that no living insects would be present in the experimental grain, the sample was subjected to subfreezing temperatures for five days. The sample was then allowed to come to room temperature.

Fifteen subsamples were then drawn, ranging in weight from 14.1925 to 14.2020 grams each. The moisture content of the sample was 12.4 per cent, as indicated by a Steinlite moisture tester. Twenty adult female rice weevils, 2 to 3 weeks of age, were introduced in each of 10 of the subsamples. Five subsamples were reserved for uninfested checks. All the samples were then placed in a room maintaining a constant temperature of 80° F. and a relative humidity of 70 per cent. The weevils were permitted to oviposit in the grain for 2 days, and then removed.

The samples remained undisturbed in the constant-temperature room for one week after the weevils were introduced. At this time and at weekly intervals thereafter, the samples were weighed on an analytical balance. To prevent changes in the moisture content and temperature of the samples, all weighing was done in the same room. Any gain or loss in weight of the check samples was due to variation in moisture content and was used as a correction factor in determining losses in weight in the infested samples.

Emergence of the adult weevils began between the fourth and fifth weeks. They were removed from the samples daily to avoid losses in weight due to feeding. After 5 weeks emergence was complete and there were no further losses in weight. Radiographs² of the samples were made by the method outlined by Milner, *et al.* 1950. The number of infested kernels was found to total 2358.

RESULTS.—Through the period of observation there was loss in weight the first week after egg deposition, increase until the end of the fourth week, and then decrease slightly in the fifth week, during pupation and adult emergence (Fig. 1).

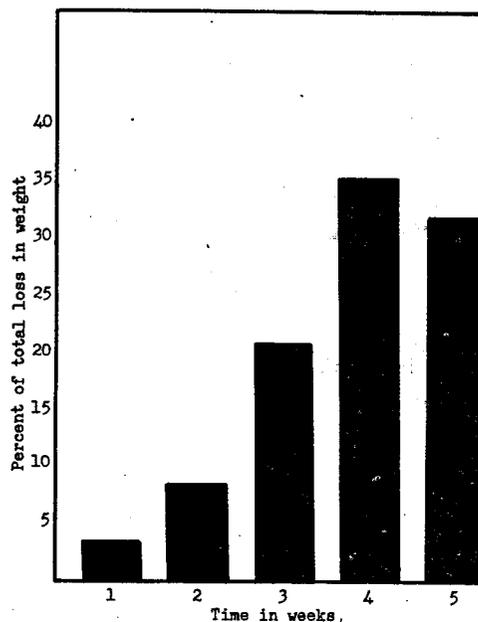


FIG. 1.—Weekly losses in weight of wheat infested with immature stages of the rice weevil.

The mean loss in weight per infested kernel was found to be 0.67 per cent after the first week of larval development, 2.36 per cent after the second week, 6.52 per cent after the third week, 13.59 per cent

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² Facilities for making radiographs were made available through the Departments of Physics and Milling Industry of Kansas State College.

after the fourth week, and 20.00 per cent upon the completion of emergence at the end of the fifth week. The weight of the refuse—*i.e.*, fecal matter, molted skins, pupal cases, and frass—left within the kernels after emergence was not determined. For this reason the total destruction of endosperm was greater than that indicated in these observations.

The average weight of newly emerged adult rice weevils was found to be 0.001225 gram, which constituted 3.76 per cent of the average weight of the whole kernel of wheat used in this work. The weight loss per kernel brought about by the development of the larva amounted to five times its adult weight.

The regression of per cent loss in weight of wheat on time is shown in figure 2. It may be noted that (1) 50 per cent of the total loss in weight occurred during the last 9.5 days of the developmental period; (2) 68 per cent of the loss occurred during the first four weeks of development when there was no outward evidence of infestation.

Only the net weight loss, due to oxidation-reduction as brought about by the metabolic processes of the immature forms of the rice weevil in its development and the weight of the adult weevil was considered in this work. This weight was dissi-

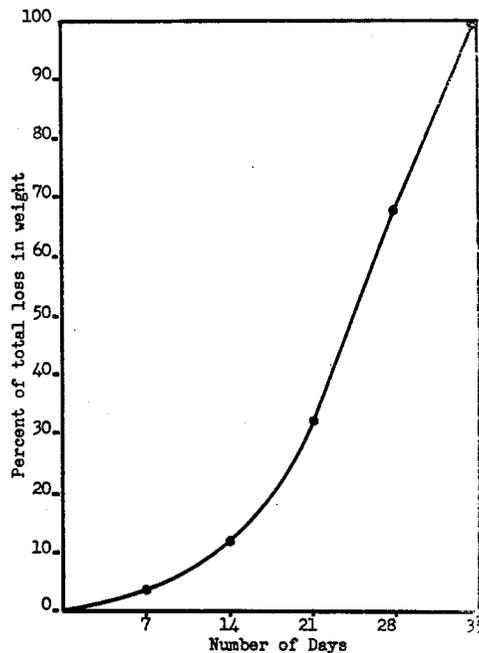


FIG. 2.—Regression of per cent of total loss in weight of wheat on time, during developmental period of the rice weevil.

pated in the form of heat, moisture, and gases, and constitutes a portion of the storage losses usually referred to by grain men as shrinkage.

LITERATURE CITED

- Milner, M., M. R. Lee, and R. Katz. 1950. Application of X-ray technique to the detection of internal insect infestation of grain. *JOUR. ECON. ENT.* 43(6) 933-5.