RELATIONSHIP BETWEEN INJURY AND DAMAGE TO
POTATOES BY WIREWORMS1-2

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Abstract

A relationship between injury (any penetration of a tuber) and damage
(in accordance with the U.S. Standards for Grades of Potatoes) caused by
the sugarbeet wireworm, Limonius californicus (Mannerheim), the Pacific
Coast wireworm, L. canus LeConte, and the Great Basin wireworm,
Ctenicera priunina (Horn), to potatoes was determined. Based on tuber
weights, the percentage of damage (D) increased curvilinearly with in-
creased percentage of injury (I). Percentages of injured and damaged tubers
based on tuber weights were significantly different from those based on
tuber count. Difference in the relationship of injury vs. damage between
untreated and fonofos-treated tubers was not significant. The regression
D = -0.012 + 0.111I + 0.003I2 can be used to estimate the amount of
damage from the amount of injury without the necessity of cutting and
measuring feeding holes.

Resumen

Se determinó en papa una relación entre las heridas (cualquier
penetración en el tubérculo) y los daños (según están definidos en el "U.S.
Standards for Grades of Potatoes) causados por el gusano alambre de la
remolacha (Limonius californicus Mannerheim), por el gusano alambre de
la costa del Pacífico (L. canus LeConte), y por el gusano alambre de la Gran
Cuenca (Ctenicera priunina Horn). Basándose en el peso de los tubérculos,
se observó que el porcentaje de daños (D) se incrementó en función
curvilinea con el aumento del porcentaje de heridas (H). Cuando los
porcentajes de tubérculos con heridas y con daños se obtuvieron basándose
en el peso de los tubérculos, estos fueron significativamente diferentes a los
basados en el conteo de los mismos. La relación entre heridas y daños en
tubérculos sin tratar y en tubérculos con "fonofos" no presentó diferencia
significativa. La ecuación de regresión D = -0.012 + 0.111H + 0.003H2

1Coleoptera: Elateridae.
2This paper reports the results of research only. Mention of a pesticide in this paper does not
constitute a recommendation for use by the USDA nor does it imply registration under FIFRA
as amended. Also, mention of a commercial product in this paper does not constitute an
endorsement of this product by the USDA.
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puede ser utilizada para estimar la cantidad de daños (D) utilizando la cantidad de heridas (H) sin necesidad de cortar y medir los orificios de alimentación.

**Introduction**

The efficacy of chemicals against wireworms infesting potatoes is based on an evaluation of tubers harvested from test plots. However, there appear to be as many different methods of evaluation as there are researchers; examples include an injury rating system based on the number of feeding punctures at least 64 mm deep (1), subjective numerical damage rating dependent upon degree of feeding (4), and the percentage of injured and damaged tubers, both presumably based on any feeding puncture, though the technique was not described (3). Not only have injury and damage been sometimes used synonymously, but damage has sometimes not even been used as defined in the U.S. Standards for Grades of Potatoes.

Defining “injury” as any penetration of a tuber by a wireworm and “damage” in accordance with Sec. 51.1554(o) of the U.S. Standards for Potatoes (23 F.R. 3141), effective July 15, 1958, Onsager (2) reported that percentage injury (I) and percentage damage (D) had a linear relationship (I = 1.436 + 1.143D; D = -0.987 + 0.836I). The criteria for damage that we used were in accordance with a later Standards, which were similar to those of the earlier Standards used by Onsager; yet in preliminary calculations, the relationship between injury and damage that we obtained appeared to differ from that of Onsager.

Reported here are the relationships between tuber injury and damage that we calculated from data obtained from evaluations of potato tubers grown in untreated and fonofos-treated plots, and a comparison of three different methods of grading.

**Materials and Methods**

Data used in this study were obtained from evaluations of tubers from fonofos-treated and untreated check plots in our field experiments on chemical control of the Pacific Coast wireworm, *Limonius canus* LeConte, the sugarbeet wireworm, *L. californicus* (Mannerheim), and the Great Basin wireworm, *Ctenicera pruinina* (Horn), infesting ‘Russet Burbank’ potatoes in Oregon and Washington from 1976 to 1979. Treatments and checks were replicated 3-4 times in each experiment and a 12-30 kg sample obtained from each replicate at harvest with a one-row digger. All tubers were washed and examined for wireworm feeding, and the percentages of injured and damaged tubers were calculated, based on weight and count of tubers. Injury was defined as any feeding penetration of a tuber by a wireworm, and damage was any injury as severe as described in Sec. 51.1560 and 51.1564 of the U.S. Standards for Grades of Potatoes (35 F.R. 18257) effective Sept. 1, 1971, as amended Feb. 5, 1972 (35 F.R. 2745).