SEED PIECE EXAMINATION: A METHOD FOR SAMPLING WIREWORMS ON POTATOES [1]

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Abstract

A sampling method was developed for wireworms on potatoes, particularly in fields with no history of wireworms or in fields that had been previously treated for wireworms. Seed pieces (potato hills) were examined at postemergence in such fields that had not been treated at planting time, and damage thresholds were established based on the number of wireworms found. In using this sampling method, a postemergence sidedress application of insecticides is made only if a damaging population is detected. This method would not only be more acceptable to growers than previously recommended soil sampling, but growers would be treating only when necessary, thereby reducing cost and environmental pollution. A control program for wireworm control on potatoes is also discussed.

Introduction

Growers often ask, if a field had been previously treated for wireworms, does it need to be treated when planting potatoes? Up to now, the only safe practice was to estimate the wireworm density based on soil sampling, then apply the proper chemical treatment (Onsager and Foiles 1969). However, because soil sampling is tedious, time consuming, and expensive, and because treatment may still be required after sampling, growers have treated their fields as an insurance without first sampling, often resulting in the needless use of insecticides.

When potato fields are planted, the seed pieces act as bait for wireworms since there is nothing else for wireworms to feed on at that time. Thus, if a correlation can be established between the number of wireworms found at the seed pieces and the amount of damage that results to tubers, then damage thresholds could be established to determine whether or not a chemical treatment is necessary. This study was therefore conducted to evaluate seed-piece examination as a method of sampling for wireworms in potato fields, and the effectiveness of postemergence sidedress application of insecticides for controlling wireworms.

Materials and Methods

A total of 28 tests were conducted, and each test was conducted in a grower's center-pivot, sprinkler-irrigated field in Oregon or Washington from 1975 to 1980. In each test, the test area was located at about the diameter (ca. 2400 ft) of the circular field, usually in rows adjacent to the pivot service road. Either 4 or 6 full rows were divided lengthwise into 25 plots so that each plot was ca. 95 ft. long.

Whenever possible, 50 soil samples were obtained per field with a 6-in. posthole digger to a depth of 18 in. and the number of wireworms found were recorded before "Russet Burbank" potatoes were planted by the grower. After emergence, 4-6 weeks after planting, 4 potato hills (a plant unit) in each plot were dug with a shovel and ca. 500 cu. in. of soil examined for wireworms. The seed pieces were then examined for feeding or presence of

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1 This 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.

wireworms. This examination was immediately followed by sidedress application of insecticides in which the granules were shanked 3-4 in. to each side and level with the seed piece in 1-in. bands with tractor-mounted Gandy ^{R} applicators, 2 rows at a time. In each test, treatments consisted of 2 lb AI/acre of diasinon 14G, Dyfonate 10G, and phorate 15G, 3 lb AI/acre of Dasanit 15G, and the untreated check; each treatment was replicated 5 times.

At harvest, 80-100 lb tuber samples were obtained from the center of each plot (15 ft/row) in rows 2 and 5 of the 6-row plots and from the 2 center rows of the 4-row plots. After washing, the tubers were examined for wireworm injury and damage. "Injury" was defined as any penetration of a tuber by a wireworm and "damage" was any injury that exceeded the allowances set forth in Sec. 51.1560 and 51.1564 of the U.S. Standards for Grades of Potatoes (35 F.R. 18257), effective September 1, 1971, as amended February 5, 1972 (37 F.R. 2745).

Data obtained from each test (field) represent mean number of wireworms from 50 soil samples, mean percentage of injured tubers per treatment at harvest, and the following from 25 plots (4 hills/plot): mean number of wireworms per hill, mean percentage infestation (wireworms present plus feeding damage in seed pieces), and mean percentage of hills with wireworms. Regression analyses were then conducted on percentage of injured tubers from untreated plots vs. the different variables: number of wireworms per soil sample, number of wireworms per hill, percentage infestation, and percentage of hills with wireworms. Regression analysis was also conducted on number of wireworms per soil sample vs. number of wireworms per hill. The effectiveness of postemergence sidedress application of insecticides in controlling wireworms were compared by analysis of variance and Duncan's multiple range test, based on percent of tubers injured and damaged.

Results

The Great Basin wireworm, Ctenicera pruinina (Horn), was found either in the soil samples or in seed piece samples in all tests. The Pacific Coast wireworm, Limonium canus LeConte, was also found in four tests, but the predominant species was the Great Basin wireworm.

The relationship between percentage of injured tubers at harvest and data from the various measurements obtained showed that mean number of wireworms per hill gave the best relationship (Fig. 1), followed by percentage infestation, which was equal to percentage hills containing wireworms, and the lowest was number of wireworms per soil sample. Since percentage damaged tubers in more important than percentage injured tubers insofar as grading of potatoes is concerned, results of our previous study (Toba et al., In prep.) was used to relate the number of wireworms per hill to percentage damaged tubers (Table 1). Thus, to keep damage below 1%, a grower should apply a postemergence sidedress application of insecticide if more than 0.05 wireworms/hill are found. Figure 2 shows that 2.5X more wireworms per hill in seed piece samples were found than wireworms per soil sample. Postemergence sidedress application of all insecticides tested reduced both injured and damaged tubers below that of the untreated check (Table 2).

Discussion

Soil sampling is important when planting a crop in fields where the population of wireworms is not known because it will not only reveal whether or not wireworms are present, but also, if present, in what density, in order to apply the proper treatment for effective control (Onsager and Foiles 1969). However, fields suspected of having few or no wireworms, particularly those with no history of wireworm damage or those that have been previously treated, may not require any treatment. To be sure, seed-piece sampling can be used after plant emergence in fields that were not treated at planting time, and a sidedress application of insecticide made only if a damaging population is detected.

Based on results of this and other studies, the following program for wireworm control on potatoes is proposed:

Year	Crop	Control Method
1	Potato	Broadcast
2	Potato	Broadcast (preferred) or Furrow
3	Rotation	
4	Rotation	
5	Potato	Furrow
6	Potato	Furrow or Seed-piece sampling
7	Rotation	
8	Rotation	
9	Potato	Seed-piece sampling
10	Potato	Seed-piece sampling

In previously uncultivated fields, a preplant broadcast application should be made for effective wireworm control. In the second year of potatoes, either broadcast or seed-piece furrow application can be made. However, broadcast is preferred because although furrow application protects the tubers from wireworm damage as effectively as broadcast, it does not necessarily mean that an euqal amount of mortality to wireworms is achieved. In the third year of potatoes, furrow application should be adequate; also, only 1/2 the rate of broadcast is used. In the fourth year of potatoes, furrow application can be used again; however, the wireworm population should have been reduced to a level that a treatment might not be required. Therefore, potatoes can be planted without any treatment, and seed-piece sampling at postemergence used to determine whether or not a damaging population remains. If it does, then a postemergence sidedress application of insecticide can be made. In subsequent years of potatoes, use seed-piece sampling.

The currently registered uses of insecticides for wireworm control on potatoes are as follows: broadcast - diazinon, Dasanit, Dyfonate, parathion; at-plant sidedress - diazinon, Dyfonate, parathion, phorate; furrow - Dyfonate, phorate; and postemergence sidedress - phorate.

Literature Cited

Onsager, J. A. and L. L. Foiles. 1969. Results of 6 years of experimentation on controlling Pacific Coast wireworms in potatoes in the Columbia Basin. Proc. 8th Annu. Wash. St. Potato Conf. p. 13-19.

Toba, H. H., J. E. Turner and D. M. Powell. 1981. Relationship between injury and damage to potatoes by wireworms. Am. Potato J. (In press).

Figure 1. Relationship between number of wireworms per hill at postemergence and percent tubers injured in untreated potatoes at harvest (n = 28).

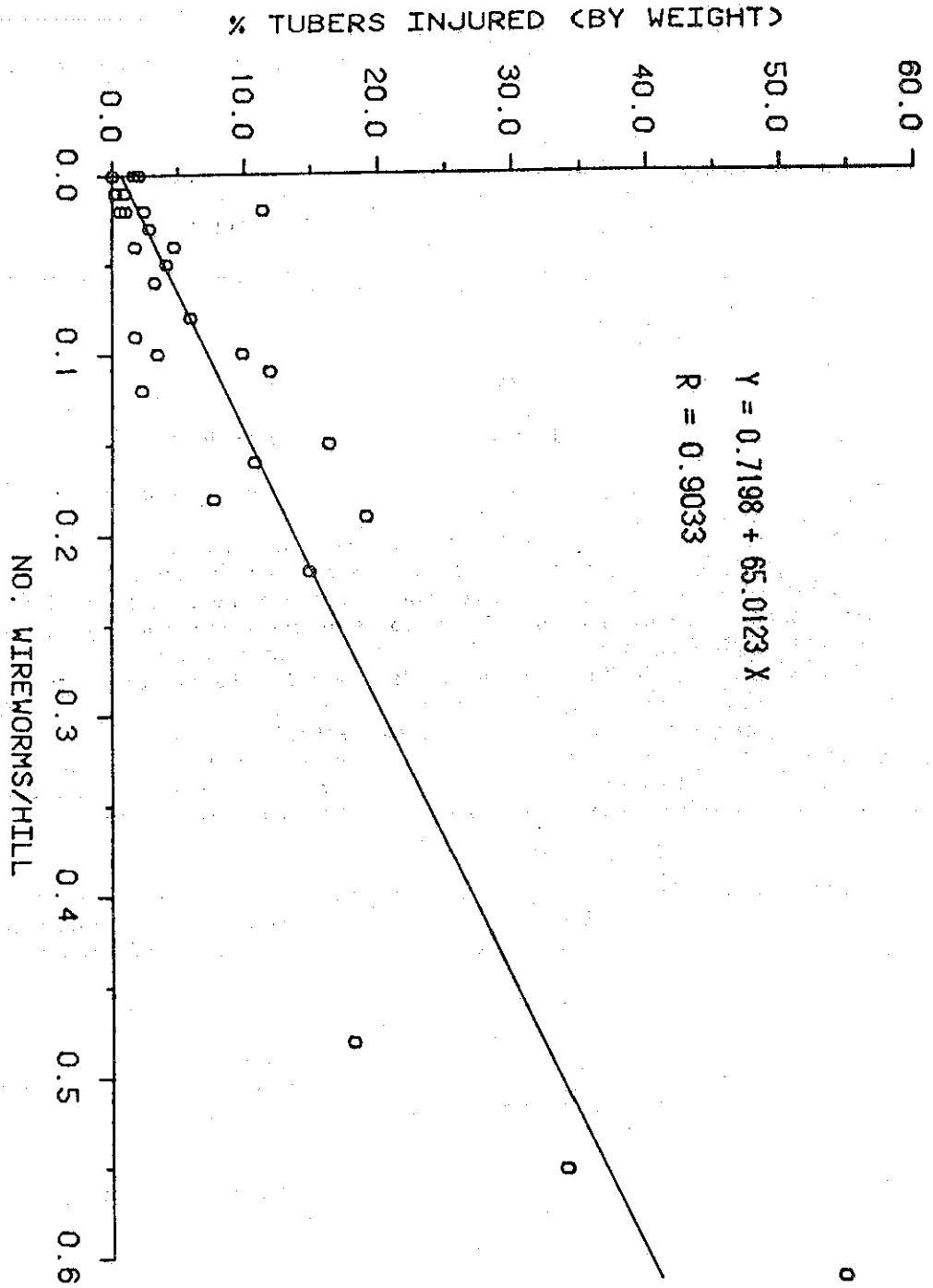

Figure 2. Relationship between number of wireworms per soil sample before planting and number of wireworms per hill at postemergence (n = 18).

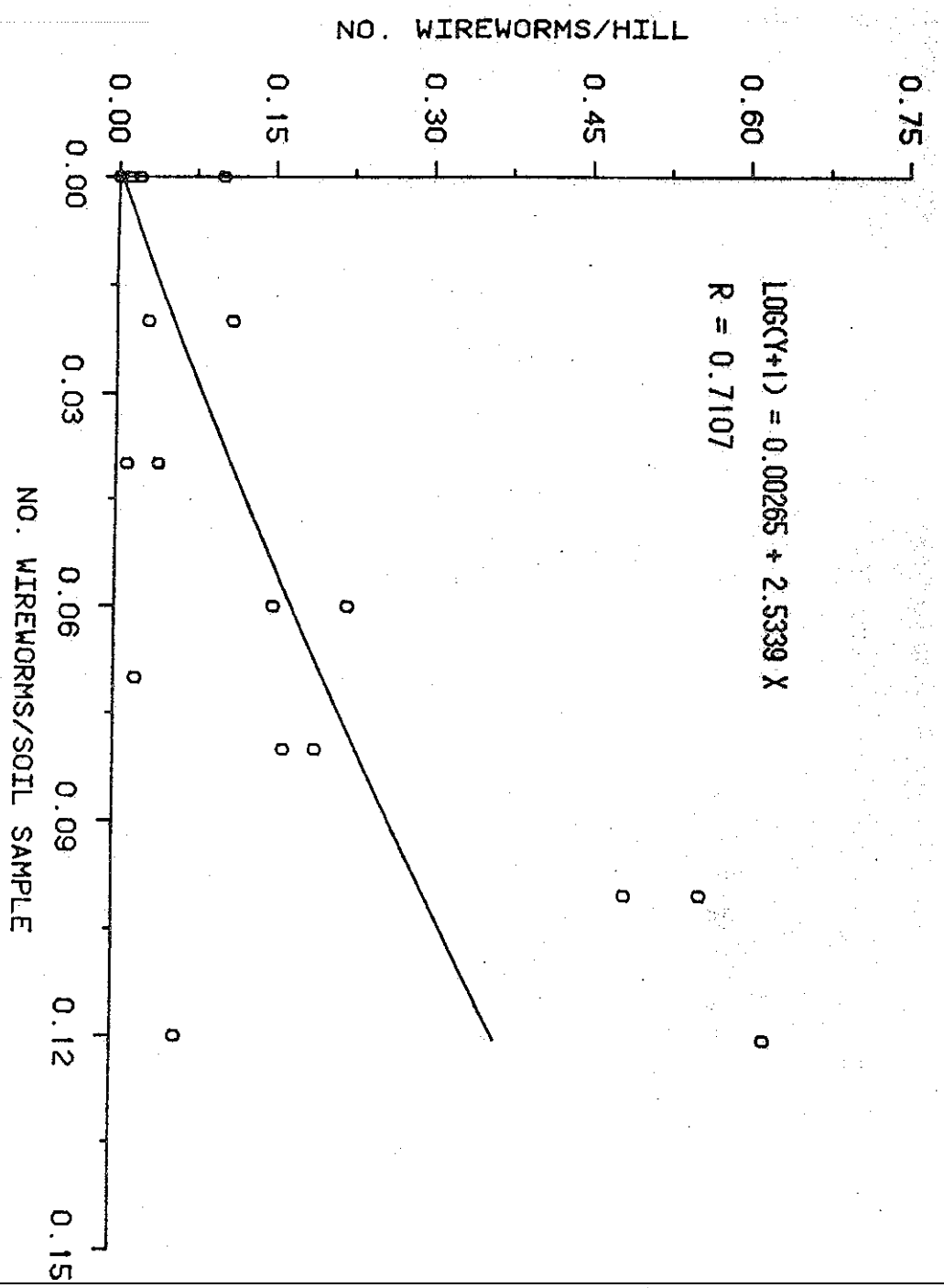

Table 1. Relationship between number of wireworms per hill and percent of tubers injured or damaged in untreated potatoes.

No. wireworms per hill	% Tubers injured[1/]	% Tubers damaged[2/]
0	3.2	0.4
.05	7.1	.9
.10	11 0	1.6
.15	14.8	2.4
.20	18.7	3.2
.25	22.6	4.2
.30	26.5	5.2

1/ Based on the upper limit of the 95% confidence interval.

2/ Determined according to Toba and Turner (In press).

Table 2. Postemergence sidedress application of insecticides for control of wireworms on potatoes (n = 23).

Insecticide	kg AI/ha	Tubers injured	% Tubers damaged
Dyfonate	2.24	1.5 a[1/]	0.2 a[1/]
Diazinon	2.24	1.8 a	.3 a
Dasanit	3.36	2.0 a	.2 a
Phorate	2.24	2.4 a	.3 a
Untreated check		6.9 b	1.1 b

1/ Means followed by the same letter within a column are not significantly different (P = 0.05), DMRT.