SOIL INSECTS OF POTATOES [1]

by
H. Harold Toba [2]

In the early days of potato production, soil insects were such a major problem that oftentimes potatoes from entire fields were rendered unmarketable due to damage caused by their feeding. All of this changed with the advent of persistent, chlorinated hydrocarbon insecticides. However, in the late 1950's, some insects began to develop a tolerance to these insecticides, and more recently these materials have been replaced by less persistent insecticides, which are effective if they are used properly. However, there are indications that soil insects are reappearing and gaining in importance. Furthermore, changes in cultural practices such as the use of large acreages for a single crop and the practice of minimum tillage or no tillage have created a new set of conditions that may favor the increase of soil insect pests.

Older growers may have become complacent and younger growers may not be aware of the potential damage that can be caused by soil insects. Brief discussions of some of the more important soil insects of potatoes are presented below.

SEEDCORN MAGGOT, Hylemya platura (Meigen)

The larvae of this fly species attack germinating seeds or seedlings of beans, peas and corn, and potato seed pieces. The dirty-looking yellowish-white maggots are about 1/4 inch long when fully grown. Although there are several generations a year, the greatest damage is done in the spring, particularly when it is wet and cool, and when the soil contains large amounts of decaying vegetation or organic fertilizer. Damage to potato crops may be in the form of reduced plant stand and yield because the maggots induce decay of seed pieces, and such reduction in seed piece size and vigor results in reduced yield. The maggots have also been implicated in the spread of the bacteria that cause blackleg disease of potatoes. This insect is of particular importance when potatoes are grown in fields previously planted to beans, peas or corn, in early planted potatoes, and in fields planted by the minimum tillage or no tillage method.

CUTWORM AND ARMYWORM

The larvae of noctuid moths are generally foliage feeders, but some will also feed on tubers, for example, the variegated cutworm, Peridroma saucia (Hubner), the spotted cutworm, Amathes c-nigrum (L.), and the bertha armyworm, Mamestra configurata Walker. Damage to tubers is likely to occur during high infestations when the plants are severely defoliated or when the vines are killed prior to harvest. Infestations are unpredictable, but damage is more likely to occur on early planted potatoes.

Table 1 shows the damage to varieties of potatoes caused by cutworms and armyworms, primarily bertha armyworms. The earlier planted Norgolds sustained higher damage than the Russet Burbanks, and Norgolds in fields that did not receive a methamidophos (Monitor®) treatment had more damage than those in fields that received it. Although aldicarb (Temik®) is effective against aphids, Colorado potato beetle, Leptinotarsa decemlineata (Say), and leafhoppers, it is not effective against noctuid larvae.

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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.

2 Research Entomologist, Yakima Agricultural Research Laboratory, Federal Research, Science and Education Administration, United States Department of Agriculture, Yakima, Washington 98902

Table 1. Damage to Potato Tubers by Cutworms and Armyworms, Boardman, Oregon - 1975

Variety	Planted	Temik (soil)	Monitor (spray)	No. Fields	% Damage Avg.	% Damage Range
Norgold	March	May	-	14	0.60	0.11-1.53
Norgold	March	May	July-Aug	5	.33	.11- .65
Russet Burbank	Mar-Apr	May	July-Aug	6	.05	0 - .12
Russet Burbank	Mar-Apr	May	July-Aug Aug-Sept	14	.01	0 - .07

FALSE WIREWORM

False wireworms are larvae of tenebrionid beetles belonging to the genus Eleodes. The black, flightless beetles have often been called "stinkbugs" due to their peculiar habit when disturbed of placing their heads on the ground, elevating the hind part of their bodies, and emitting an offensive odor. Several species occur naturally in dry-land wheat and in sagebrush land. They have a 2-year life cycle with overlapping broods: one brood overwinters as larvae that resume feeding in spring and develop to adults; the other brood overwinters as adults that mate in spring and start a new generation. The habits and appearance of false wireworms are similar to those of "true" wireworms, but are generally larger and move about more rapidly than wireworms. They prefer small grains, such as wheat, but they also attack beans, sugarbeet, potatoes, and other crops. Their economic importance on potatoes is not known, but it was demonstrated in the laboratory that they do feed on potatoes.

WIREWORM

Wireworms are larvae of click beetles. There are three economically important species in the Pacific Northwest: Pacific Coast wireworm, Limonius canus LeConte; sugarbeet wireworm, Limonium californicus (Mannerheim); and Great Basin wireworm, Ctenicera pruinina (Horn). The Limonius species prefer moist conditions and are found in irrigated lands. The Pacific Coast wireworm prefers sandy soils such as those found in the Columbia Basin and Pasco. The sugarbeet wireworm is found in heavier soils of Yakima Valley and Ellensburg. The Great Basin wireworm prefers drier conditions and is found where annual rainfall does not exceed 15 inches as in dry-land wheat and in sagebrush land.

These three species have long life cycles, ranging from 2 to 6 years. The larvae require several years to mature; they overwinter 12 to 24 inches deep in the soil and then return to near the surface in the spring to resume feeding. Although infestations do not spread rapidly within a field and from field to field, one can expect infestations to become progressively worse each year if no control measures are taken. Effective control of wireworms is dependent upon the use of the proper insecticide treatment against a given population. A band treatment will control a low population, but a broadcast treatment is required for a higher population, and both broadcast and band or fumigation may be required for an even higher population. The best way to determine the population density in a potato field is by soil sampling before planting.

RESEARCH ON WIREWORMS

New compounds are evaluated continually to insure the availability of effective insecticides in the event (1) the insects build up a tolerance or resistance to presently used insecticides, and (2) the insecticides are banned from use. The new compounds are first screened by laboratory bioassays and then evaluated in the field for effectiveness. Table 2 shows the results of field tests in which the new compounds (CGA 12223, Bay SRA 12869 (Oftanol®), and ethoprop (Mocap®)) were found to be equal in effectiveness to fonofos (Dyfonate®) in reducing wireworm injury to potatoes. However, band treatments did not sufficiently reduce injury when the wireworm population was moderately high (1975 and 1976).

Table 2. Field Evaluation of Compounds Used as Preplant Broadcast and at Plant Band Applications for Wireworm Control

	Percent of tubers injured (by weight)					
	1975		1976		1977	
Compound	Broadcast	Band	Broadcast	Band	Broadcast	Band
Dyfonate	1.8	13.9	1.7	22.3	0	4.3
Diazinon	1.3	9.0				
Dasanit	7.6	9.7	8.8	23.3	.5	2.3
CGA 12223	5.5	14.7	0	6.0	0	3.0
Oftanol	1.1	17.2	3.9	15.9	0	2.7
Mocap			10.2	5.4	0	1.1
Check	32.5	33.8	48.9	56.5	15.6	16.1

Another study is in progress to determine the feasibility of using potato seed pieces as a means of sampling for wireworms. With this sampling method, a grower with a field having a history of a low or no wireworm population or a field that has been previously treated could forego any treatment until he checked the seed pieces to determine whether an economic infestation was present. If there was, he could then apply a postemergence band treatment to protect tubers from wireworm injury. Soil samples were therefore taken in growers' fields, seed pieces in untreated rows were checked for wireworm infestations (wireworms present and/or seed pieces fed on), insecticides were applied as postmergence band treatments to replicated plots, and tuber samples obtained at harvest time were evaluated. There was some relationship between seed piece infestation and tuber injury, but there were exceptions (Table 3). However, the insecticides used as postemergence applications effectively protected the tubers (Table 4). Although these insecticides are currently registered for use as at plant band applications, they are not registered for use as postemergence application.

In another field test, four types of insecticide applications were compared: at plant band, at plant seed piece furrow, postmergence band, and preplant broadcast. Table 5 shows that, as expected, broadcast applications gave better control than band applications because the wireworm population was moderately high. The furrow application gave control comparable to that of broadcast application probably because the insecticides were applied at the seed pieces, and the initial feeding by wireworms was on the seed pieces. Postemergence band, which was also comparable to broadcast, gave better control than at plant band even though the methods of application were similar. The reason may have been that when the insecticides were applied later in the growing season, more wireworms were near the surface and thus a higher percentage was killed.

Table 3. Relationship of Soil Sampling, Seed Piece Infestation, and Tuber Injury at Harvest in Field Study on Wireworms

Field	Wireworms in soil sample	% infested seed piece	% tubers injured
SA		12.0	1.7
SB	1/50	11.0	2.6
SC	0/50	26.0	3.6
SD		9.0	1.6
SF	0/50	2.0	2.0
SH	10/150	2.0	11.7
SI	2/25	18.0	10.5
SS	4/56	12.5	43.8

Table 4. Control of Wireworms Following Postemergence Band Application of Insecticides, 1977

	Field location							
	SA	SB	SC	SD	SF	SH	SI	SS
	% Injured by weight							
Diazinon	0.2	0.7	1.1	1.1	0.5	1.4	2.0	7.1
Dasanit	.6	.1	1.9	.7	.8	5.7	.8	5.1
Dyfonate	0	.2	.7	.4	0	5.1	4.3	12.5
Thimet	.1	.6	2.9	.2	1.7	10.5	4.6	2.8
Check	1.7	2.6	3.6	1.6	2.0	11.7	10.5	43.8

Table 5. Field Comparison of Different Types of Insecticide Application for Wireworm Control, 1977

	% Control Based on % Tubers Injured			
Compound	At plant band	Seed piece furrow	Postemergence band	Preplant broadcast
Thimet	61	78	92	73
Dyfonate	64	90	77	98
Dasanit	65	85	88	88
Diazinon	46	53	87	
Untreated check:	% injured range	24-74%		