WIREWORM CONTROL TRIALS IN CORN

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INTRODUCTION

Wireworms are one of the most common soil insect problems affected corn production in North Dakota, especially in the sandhills area of southeastern North Dakota. Field sampling and anylysis of species collected throughout this area has revealed the presence of a single wireworm species, *Melanotus communis* (Gyllenhal), causing economic damage to corn. In North Dakota this insect is not known to damage crops other than corn although the literature indicates that it also feeds on tobacco (Peterson, 1960).

Corn is damaged by wireworms early in the growing season when the crop is in the seedling stage. Wireworms will feed on the seed (Fig. 1) causing poor germination or larvae will tunnel into the below grown portion of the stem slightly above the roots (Fig. 2). Stem feeding causes the seedling plant to wilt and die. In field areas heavily infested with wireworms (usually lower poorly drained areas), there will normally be thin, patchy stands of corn (Fig. 3). Once corn develops beyond the seedling stage, wireworm larvae feed on the small, tender roots until soil moisture becomes depleted due to insufficient rainfall. Wireworm larvae then begin to migrate deeper into the soil as the upper soil level begins to lose moisture.

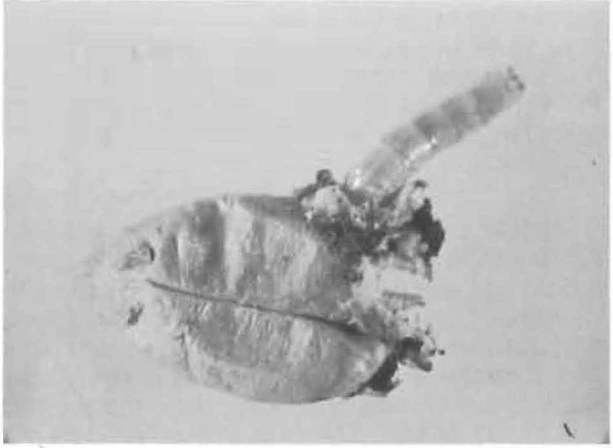

Figure 1

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Figure 2

Figure 3

Wireworms are frequently a problem in corn following long standing pastures or meadows. However, they have also been found to build up in corn following corn as well.

There are no effective postemergence controls for wireworms. In fields where wireworm problems are anticipated or known to occur, controls must be used at planting time.

In the 1960s, chlorinated hydrocarbon insecticides such as chlordane and heptachlor were registerd and used as preplant broadcast treatments for wireworm control in corn. However, the registration of these insecticides for such use and many others were cancelled by the EPA in the early 1970s leaving the corn producer without an effective means of preventing wireworm damage in corn. An exception is lindane seed treatment which, based on our trials and field observations, cannot be expected to provide adeqaute wireworm control with moderate to heavy infestations.

Several factors prompted the initiation of wireworm control trials in 1970:

(a) The loss of registration for chlorinated hydrocarbon insecticides.

(b) Complaints from corn growers that insecticide seed treatments were not providing adequate control.

(c) Western corn rootworm infestations were detected in southeastern North Dakota.

With the arrival of western corn rootworm in North Dakota and the fact that certain granular insecticides are registerred for control of this insect, testing of these compounds for wireworms was considered a logical approach. Effective results of granular rootworm insecticides on wireworms could minimize losses from both rootworms and wireworms with a single insecticidal treatment at planting time.

Materials and Methods

All of the wireworm control trials were conducted on farms located in the sandhills area of Richland, Ransom and Cass Counties in southeastern North Dakota. This study area was selected because it had a documented crop loss due to wireworms over previous seasons (McBride, 1971). The insecticides tested were mainly granular planting time formulations provided by various chemical companies (see acknowledgements).

All granular insecticides were applied with Gandy, John Deere or International Harvester granular application equipment. Band applications were made in 6 or 7-inch bands ahead of the press wheels and behind planter shoes. In-furrow treatments were made by removing row banders and allowing granules to drop into the furrow ahead of the press wheels. During the early years of testing, slightly longer granular application tubes were cut to fit into the holes provided at the back of the planter shoes on John Deere corn planters.

Planters utilized in wireworm trials were those provided by farmer-cooperators. Row spacings were 30, 36 or 38 inches with seeding rates ranging from 18,000 to 21,000 kernels per acre.

All treatments were applied as single row treatments replicated three times in a modified randomized complete block design. Since wireworm damage is directed at both the planted seed and seedling stage of the crop, stand counts were felt to be most reflective of crop protection. Stand counts were taken in 50 feet of row three to four weeks after corn emergence when wireworm effects on the plants would be most evident. Stand count data were summarized and analyzed using Duncan's Multiple Range Test.

In summarizing data on treatments selected for their consistent performance over the years, it was necessary to calculate one missing value. This was done according to Yates (1933). Friedman's test (1937) for nonparametric statistics was used to determine significance of differences among the treatments. This test was used to avoid making an assumption of normality in the distribution of data. The data consisted of treatment means from years that each treatment was used. The replicates consisted of years or groups of years. i.e. 1970-73, 1974, 1975, 1976 and 1979-82 (excluding 1977 and 1978 when wireworm trials were not conducted). The reason for grouping of years was to minimize the number of missing treatment means in the analysis.

During certain years in the 1970s and early 1980s, requests were received from several chemical companies to include selected seed treatments in the wireworm trials. These requests were accepted and the seed treatments were tested. However, since the seed treatments were not included during most years of the continuing wireworm trial, the stand count data obtained from these treatments is not included in this report. It should be sufficient to indicate that, overall, in most cases the seed treatments compared closely to the untreated checks or at best gave only slight indications of minimal stand protection and control.

Stand count data for certain granular insecticides also are not presented in this report either because they may have only been in the trials for a year or two (mainly due to inadequate control) or they are no longer registered (aldrin and chlordane).

Table 1 presents a complete listing of all insecticides evaluated in the wireworm control trials beginning in 1970 and continuing through 1982. Insecticides indicated with an asterisk are those selected for analysis and reporting because: (a) they provided the most consistent performance during the years of testing for wireworm control and (b) all are currently registered for wireworm control in corn.

Results and Discussion

The data presented in Table 2 is a summary of the stand count data for selected insecticide treatments obtained from wireworm control trials conducted during this period 1970-1982.

The results of Friedman's chi-square test indicates that there are highly significant differences among

TABLE 1. Insecticides Evaluated For Wireworm Control In Corn During The Period 1970-1982

Granules	Seed Treatments
Abbott 47171 10G	Chlordane
AC 92100 15G (Counter)	Diazinon, Lindane, Captan
Aldrin 20G	Dursban-Captan combination (TF-3486)
*Amaze 20G	Furadan
Bay 92114 10G (Amaze)	Lindane
Bay SRA 12869 15G (Amaze)	Lindane-Captan combination (Isotox)
Baygon 15G	Lindane-Maneb combination (Agsco DB Green)
Belt 33G (Chlordane)	Orthene
CGA 12223 15G and 20G	
*Counter 15G (also Counter 15G coated granules)	
Cytrolane 15G	
Dasanit 15G	
Diazinon 14G	
Dotan 15G	
Dowco 275 10G	
*Dyfonate 10G and 20G (also Dyfonate 20G -DEG coated granules)	
*Furadan 10G and 15G	
Landrin 15G	
Lorsban 10G and 15G	
*Mocap 10G (also Mocap 10G coated granules)	
Temik 15G	
*Thimet 15G and 20G	

*Denotes insecticides selected for analysis and evaluation as presented in this report.

treatments. The value calculated with the test procedure was 23.750; the table value for chi-square at 9 degrees of freedom is 23.589 with probability of error of .005 percent.

Considering the treatment averages in Table 2, the conclusion is made that the treatments with averages of 47.2 plants per 50 feet of row (Mocap 10G — 1 lb. AI/A band) to 50.9 plants per 50 feet of row (Furadan 10G — 1 lb. AI/A in-furrow) provided the best control of wireworms over the years of testing. Counter 15G and Thimet 15G provided control equal to Mocap 10G and Furadan 10G. While Furadan 10G — 2 lbs. AI/A band and Dyfonate 10G or 20G — 1 lb. AI/A band compared closely to each other, providing some degree of efficacy, they did not perform as well as the treatments previously mentioned.

Amaze 20G, according to this long term test, did not perform as well as the other treatments. However, the means of 39.5 plants per 50 feet of row is based on all years of testing indicated. During the early years of testing (1973-1975), this compound was an experimental formulation (10G and 15G) and was not registered on corn. The data for the previously mentioned years indicates poor performance which may have been due to inconsistencies in formulation. When testing of Amaze 20G for wireworms was resumed during the years 1981 and 1982, this insecticide provided good wireworm control as indicated by a stand count average of 56.6 corn plants per 50 feet of row which compares favorably with the better treatments (Table 2).

A graphic summary of the insecticide performance data is presented in Fig. 4.

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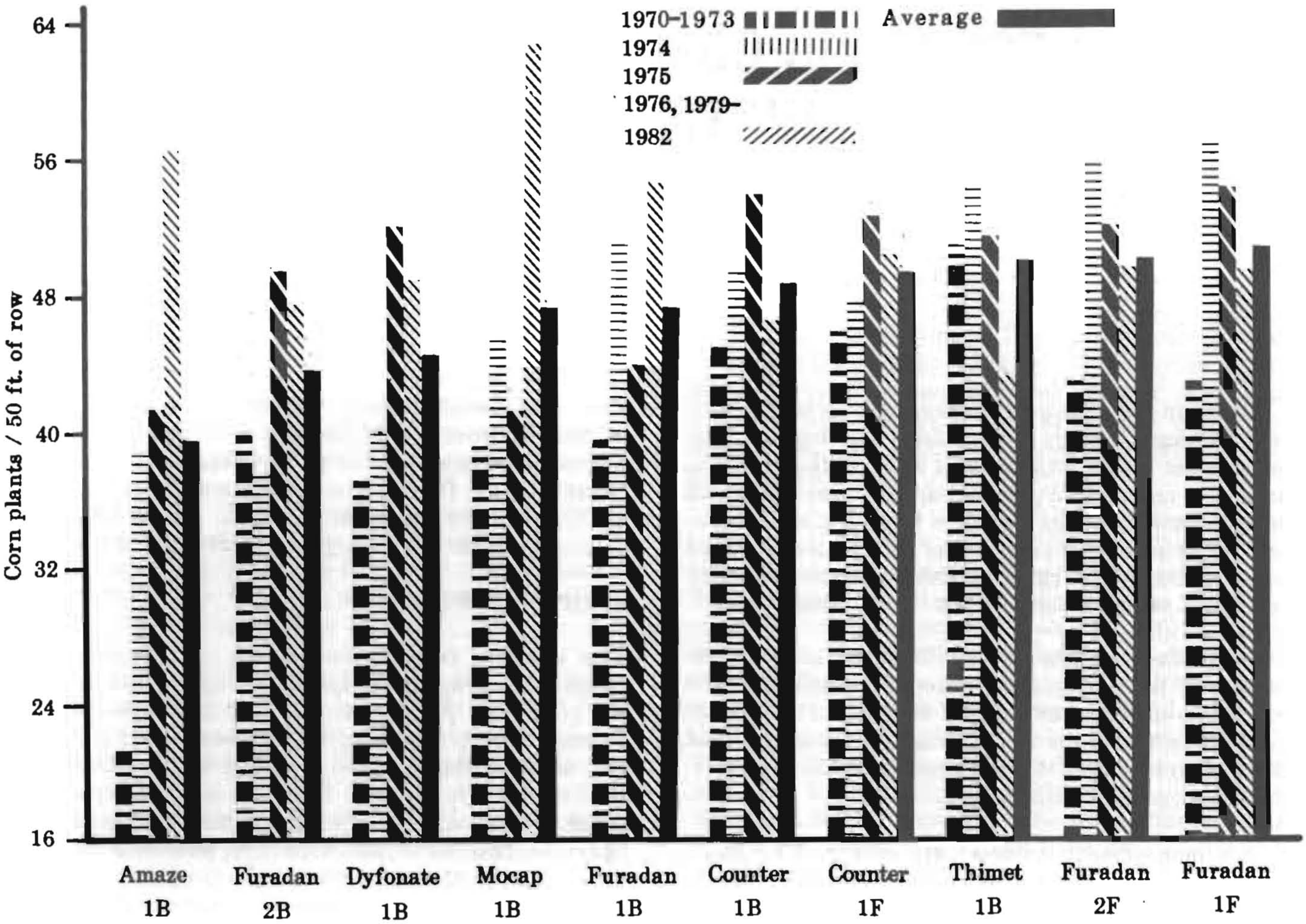
Table 2. Summary of Ranked Mean Counts[1] of Corn Plants in 50 Feet of Row in Plots Treated With Selected Insecticides for Wireworm Control, Sandhills Area of Cass, Ransom and Richland Counties in North Dakota.

Treatment			Year(s) and Rank								
		Application									
Insecticide	Lbs. AI/A	[In A Band (B)][2] [In The Furrow (F)][3]	1970-1973	Rank	1974	Rank	1975	Rank	1976 and 1979-82	Rank	Treatment Average
Amaze	1	B	21.3	1	38.7	2	41.3	1.5[4]	56.6	9	39.5
Furadan	2	B	40.0	5	37.3	1[5]	49.6	4[6]	47.5[11]	3	43.6
Dyfonate	1	B	37.1	2	40.0	3	52.0	6.5[4, 10]	49.0	4	44.5
Mocap	1	B	39.0	3	45.3	4	41.3	1.5[4]	63.0	10	47.2
Furadan	1	B	39.7	4	51.0	7[6]	44.0	3[7]	54.8	8	47.3
Counter	1	B	45.0	8	49.3	6	54.0	9	46.5	2	48.7
Counter	1	F	46.0	9	47.7	5	52.7	8	50.3	7	49.2
Thimet	1	B	51.0	10	54.3	8	51.3	5	43.3	1	50.0
Furadan	2	F	43.0	6.5[4]	55.7	9	52.0	6.5[4]	49.6	6	50.1
Furadan	1	F	43.0	6.5[4, 8]	56.7	10	54.3	10	49.5	5[9]	50.9

[1]Ranked from lowest to highest stand count.
[2]Applied in 6 or 7 inch band over the row and ahead of the press wheel at planting time.
[3]Applied in the furrow ahead of the press wheel at planting time.
[4]Numbers with fractions indicate a tie in rank.
[5]Applied in 1973.
[6]Applied in 1976.
[7]Applied in 1980.
[8]Average from applications in 1973 and 1981.
[9]Average from applications in 1976 and 1982.
[10]Average from applications in 1975 and 1976.
[11]Calculated according to Yates, 1933 for a missing mean.



Treatment (numbers indicate lbs. actual insectide/acre, B indicates application in a 6 or 7 in. band over the row when planting, F indicates infurrow application at planting time)

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