

2009

Wireworm Control with Oriental Mustard and High Neonicotinoid Rates



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with
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► Background:

Producers and field man have reported wireworm (*Limonius Californicus* and *Ctenicera Californicus*) populations and crop damage in spring cereals increasing across eastern Washington. Multiple reasons for this have been expressed including removal of Lindane® insecticide from the market place, increased conservation tillage, and increased education and awareness.

Currently cereal crops are treated for wireworm control with neonicotinoid insecticides such as Cruiser® (thiamethoxam) and Gaucho® (imidacloprid) at rates between 0.19-0.25 oz/cwt, and mustard is treated with a neonicotinoid at 10.00 oz/cwt. It is important to point out that these insecticides are applied per cwt and not on a per acre basis, thus heavier seeding rates increase the amount of active ingredient on a per acre basis. At these rates, the neonicotinoids are toxic to wireworms but at sub-lethal doses, or in other words they repel or provide some seedling protection.



'Pacific Gold' oriental condiment mustard (*Brassica juncea* L.) primarily produces 2-propenyl glucosinolates (Brown et al., 2004) which breaks down into ally isothiocyanate. Isothiocyanates have been shown to be toxic and repellent to wireworms (Lehman, 1942).

► Objective:

The objectives of this study are to determine:

1. If oriental mustard raised for seed and not incorporated into the soil,
and/or
2. A high application rate of neonicatamide insecticide on spring wheat, are "lethal" to wireworms and can economically reduce populations in the soil and improve subsequent crop production.

► Study Location:

Location: 2 miles north of Davenport, WA.

Annual precipitation: 14-15 inches.

Soil type: Silt loam.

Crop Sequence: continuous spring cereal, recrop winter wheat rotation

► Treatments and Operations:

Treatments were seeded with a Seed Hawk direct seed drill on 12 inch spacing. Oriental mustard treatments were seeded on April 29, 2008 at a rate of 5 lb/ac, and fertilized at 45-0-0-15 applied deep and 1 gal/ac of Pro-Germinator™ with the seed. DNS wheat treatments were seeded on May 1, 2008 at 70 lb/ac, and fertilized at 60-0-0-17 applied deep and 1

gal/ac of Pro-Germinator™ with the seed. Weed pressure was low as labeled herbicides were applied to each crop as needed. The trial is a randomized complete block design with 4 replications. The four treatments are as follows:

<u>Treatment</u>	<u>Variety/Class</u>	<u>Cruiser</u>	<u>Gaucho</u>
OM-0.0	'Pacific Gold' Oriental Mustard	0.00 oz/cwt	0.00 oz/cwt
OM-10.0	'Pacific Gold' Oriental Mustard	10.00 oz/cwt	0.00 oz/cwt
SW-0.0	'Jefferson' DNS Wheat	0.00 oz/cwt	0.00 oz/cwt
SW-2.0	'Jefferson' DNS Wheat	0.00 oz/cwt	2.00 oz/cwt

Subsequent winter wheat was seeded into the trial with a Seed Hawk direct seed drill on October 1, 2008. 'ORCF 102' was seeded at 70 lb/ac, and fertilized at 80-0-0-10 applied deep and 1 gal/ac of Pro-Germinator™ with the seed.



► Agronomic and Economic Results:

Wireworm Populations (2008)

The 15.4 acre on-farm test location was selected because of previously diagnosed wireworm damage on spring cereal production. Sixteen modified wireworm solar bait traps were put out across the location 10 days prior to seeding and removed at 1st seeding date to determine wireworm populations. Overall the location averaged 4.3 wireworms per trap (high population) and ranged from 0 to 18 wireworms per trap.

Mustard and Spring Wheat Performance (2008)

There was no difference in yield between mustard and spring wheat treatments averaging 916.8 lb/ac (Table 1). Spring wheat yield was greatly reduced because of an early July frost event. An increased yield trend was observed but differences were not significant between SW-0.0 and SW-2.0 with an average yield of 13.6 and 16.6 bu/ac. Because of market price and reduced yield in spring wheat due to frost, differences in economic performance were detected. Treatments OM-0.0 and OM-10.0 averaged \$349 and \$336/ac compared to treatments SW-0.0 and SW-2.0 which averaged only \$125 and \$151/ac. Economic return over wireworm costs were also significantly different with OM-0.0 and OM-10.0 averaged \$349 and \$334/ac compared to treatments SW-0.0 and SW-2.0 which averaged only \$125 and \$141/ac.

Wireworm Population and Subsequent Winter Wheat Production (2009)

Four modified solar bait traps were set in the spring of the year into each plot (64 traps total) seeded to recrop winter wheat as soil temperature reached 50° F. The traps were removed after 8 days and wireworms were counted. Wireworm populations and subsequent grain yields differences were not significant ($P < 0.05$) between treatments but a trend could be detected. Subsequent winter wheat yield and wireworm populations averaged nearly 40 bu/ac and 2.0 wireworms per trap following OM-0.0, OM-10.0 and SW-0.0 but averaged 42 bu/ac and only 0.4 wireworms following SW-2.0 (Figure 1).

► Conclusions:

Oriental mustard taken to seed production, and not incorporated into the soil, produced greater economic returns than spring wheat in rotation (Figure 2), but it did not appear to have any detrimental (lethal) impact on wireworm populations. Consequently, despite the increased costs, a high application rate of neonicotinoid insecticide on spring wheat produced economic returns equal to no insecticide application. Further more additional research is needed but preliminary results are encouraging that a high application rate of neonicotinoid insecticide may reduce wireworm populations and improve subsequent crop yields.



► Agronomic and Economic Data:

Table 1. Average yield, gross economic return and economic return over wireworm control costs in an on-farm test and Dewald's farm north of Davenport, WA.

Treatments	Yield (unit/ac)	Yield (#/ac)	Gross economic return (\$/ac)	Return over input costs (\$/ac)
OM-0.0	942 lb	942	349 a	349 a
OM-10.0	909 lb	909	336 a	334 a
SW-0.0	13.6 bu	818	125 b	125 b
SW-2.0	16.6 bu	998	151 b	141 b
LSD _(0.05)	-	n.s.	36	036
/	-	98.7%	9.5%	9.5%

† Treatment means within columns followed by the same letter are not significantly different at the 95% probability level ($P < 0.05$).

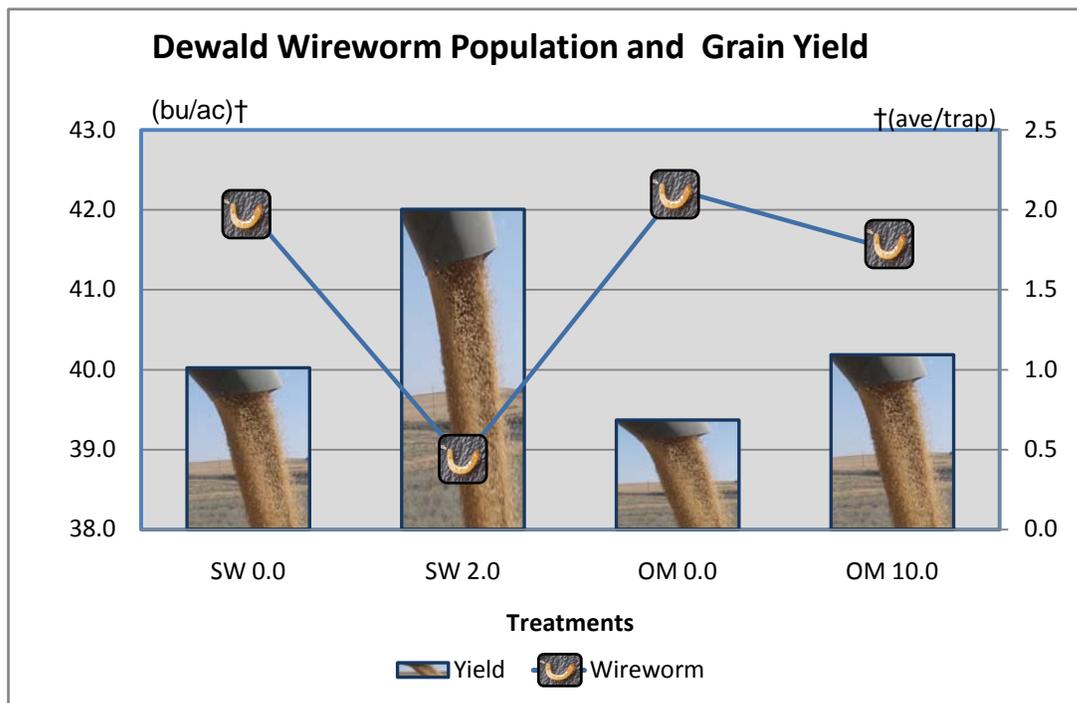


Figure 1. Wireworm population (ave/trap) in the spring of 2009 and subsequent winter wheat yield (bu/ac) following treatment in 2008 in an on-farm test and Dewald's farm north of Davenport, WA.

† Wireworm populations and grain yield treatments are not significantly different at the 95% probability level ($P < 0.05$).

► Conclusions:

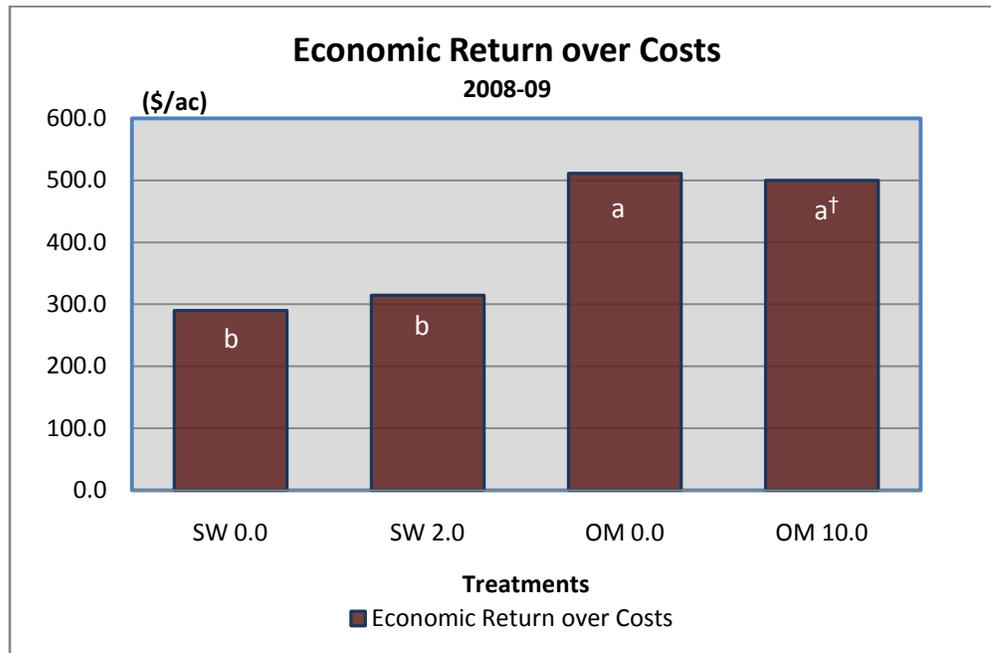


Figure 2. Economic return over wireworm costs combined over 2008 (treatment crops) and 2009 (subsequent winter wheat) in 2008 in an on-farm test and Dewald's farm north of Davenport, WA.

† Treatment means within columns followed by the same letter are not significantly different at the 95% probability level ($P < 0.05$).

Citations:

Brown, J., J.B. Davis, D.A. Brown, L. Seip, and T. Gosselin. 2004. Registration of 'Pacific Gold' oriental condiment mustard. *Crop Science* 44:2271-2272.

Lehman, R.S. 1942. Laboratory test of organic fumigants for wireworms. *J. Econ Entomol.* 35: 659-661.

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