

Wheat Yield and Quality Response to Management of the Aphid-BYDV Complex

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Barley yellow dwarf virus (BYDV) is one of the most prevalent viral diseases in soft red winter wheat. Mild winters in conjunction with early planting of soft red winter wheat have led to an increase in the occurrence of BYDV. In 2002 producers reported stunting and yellowing of plants. Plant samples were taken and analyzed at MU. Results indicated the presence of BYDV. At harvest, producers noticed yield reductions of up to 50%. The impact of BYDV on crop yield is not fully understood. Several wheat regions have developed economic thresholds that vary substantially, making it hard to determine which threshold to use. Therefore, research was conducted to quantify the affect of variety selection and insecticide treatment timings on soft red winter wheat yield and to determine economic optimum thresholds to manage this pest complex.

Materials and Methods:

Field studies were conducted in the 2002-2003 winter wheat growing season at the Bradford Research and Extension Center. The experimental design was a randomized complete block factorial design. The main plot factors were variety and insecticide treatment timings. The four varieties were MO 98O525, Ernie, Roane, and P 25R37. Insecticide treatment consisted of imidacloprid (Gaucho) and lambda-cyhalothrin (Warrior) (Table 3). Aphid species were counted every three weeks from emergence to physiological maturity. Leaf samples were taken at heading (Zadoks 59) to verify virus presence using ELISA. Winter wheat was harvested at physiological maturity and adjusted to 13% moisture. Three off-site, producer fields were also set up with various insecticide treatment timings.

Results and Discussion:

Wheat was at Zadoks growth stage 15, 22 (5 leaf, 2 tiller) in early November when aphids were first present in the plots. Aphid numbers remained well below 1 per plant throughout the winter. Aphid numbers peaked in late April with 16 aphids per stem at Zadoks growth stage 31 (1st node). Aphid numbers then dropped back below 1 per plant in mid-May at Zadoks growth stage 57 (3/4 of inflorescence emerged). The predominant aphid species was oat bird-cherry aphid. This species is associated with the PAV strain of barley yellow dwarf (Table 1). Seventy-five percent of the untreated plots that exhibited virus symptoms tested positive for PAV, the common BYDV strain in the Midwest. P25R37 and MO98O525 had the highest yield and lowest number of heads m⁻¹ (Table 2). Averaged over all varieties, wheat yield was reduced 18% in the untreated plots when compared to the treated control. Fall followed by spring applications of lambda-cyhalothrin (Warrior) with or without imidacloprid (Gaucho) resulted in the greatest test weight, and grain yield (Table 3). There was no significant difference between treatments for the number of heads m⁻¹ and kernels head⁻¹. Fall followed by

spring lambda-cyhalothrin, with or without imidacloprid resulted in a significantly higher TKW than fall lambda-cyhalothrin with or without imidacloprid.

Preliminary data indicates that aphid infestation as late as jointing may result in significant yield loss.

Table 1. BYDV strain associated with aphid species

Aphid species	BYDV strain
oat bird cherry aphid (<i>Rhopalosiphum padi</i>)	PAV, RPV
Greenbug (<i>Schizaphis graminum</i>)	SGV
corn leaf aphid (<i>Rhopalosiphum maidis</i>)	RMV
English grain aphid (<i>Sitobion avenae</i>)	PAV, MAV

Table 2. Variety Yield Response

Variety	Yield bu a ⁻¹	Heads m ⁻¹	Kernels head ⁻¹	Test wt.	TKW
MO 98O525	117.7 a	118.8 b	45.2 a	60.4 b	36.1 c
Ernie	104.8 b	145.9 a	26.2 c	59.7 b	40.6 b
Roane	110.1 b	158.9 a	36.6 b	62.1 a	31.5 d
P 25R37	117.6 a	127.6 b	36.9 b	61.9 a	44.5 a
LSD (0.05)	7.3	14.3	3.3	.9	0.8

*Means with the same letter are not significantly different.

Table 3. Yield Response to Aphid Management Strategy

Treatment	Yield bu a ⁻¹	Heads m ⁻¹	Kernels head ⁻¹	Test wt.	TKW
1-untreated	99.4 d	133.0 a	35.4 a	60.8 ab	35.9 c
2-treated control	117.3 a	140.2 a	35.5 a	61.7 a	39.8 a
3-fall Warrior	106.6 bcd	137.5 a	38.0 a	60.6 ab	37.2 b
4-fall fb spring Warrior	116.7 ab	137.3 a	36.3 a	61.2 a	39.0 a
5-Gaucht only	103.9 cd	136.8 a	37.0 a	59.9 b	37.1 b
6-Gaucht + treated control	121.9 a	138.8 a	35.6 a	61.5 a	39.7 a
7-Gaucht + fall Warrior	114.1 abc	134.0 a	37.9 a	61.0 ab	37.7 b
8-Gaucht + fall fb spring Warrior	120.4 a	144.8 a	34.2 a	61.7 a	38.9 a
LSD (0.05)	10.3	20.2	4.7	1.3	1.1

*Means with the same letter are not significantly different.

**Treated control consisted of application of lambda-cyhalothrin every 28 days.