OSU Extension Service Crop Science Report

Russian Wheat Aphid - to Spray or Not to Spray

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When Russian wheat aphids are found in a grain field the first question that comes to mind is "Should I spray them?" We all recognize that RWA can cause serious damage to cereal crops, but should you spray to control them? Will the spray be effective? The answer is "We're not sure." Research conducted in Oregon to date documents that aphid populations can be reduced by sprays, but often this reduction is not correlated with yield increase. This publication provides some basic background on Russian Wheat aphid, current economic threshold levels and results of spray studies conducted in eastern Oregon.

Biology

The mean daily temperature range for development and reproduction of RWA is approximately 41 to 86°F. Development and reproduction are reduced when temperatures are above or below this range. Wingless aphids require 250 degree-days Fahrenheit (158 Celsius) to develop from birth to onset of reproduction using a base temperature of 39.4 °F (4.1 °C). Table 1 gives 30-year mean daily temperatures for Moro and Pendleton and the number of days required at each of these temperatures for an aphid to develop from birth to adulthood.

Table 1. 30-year mean daily temperatures (MDT) by month and the number of days required for RWA to develop from birth to adulthood at these temperatures for Moro and Pendleton, OR.

Month	Moro		Pendleton	
	MDT °F	Days for RWA development	MDT °F	Days for RWA development
S	59	13	63	11
O	49	26	52	20
N	39	--	42	60
D	32	--	34	--
J	31	--	34	--
F	36	--	34	--
M	41	60	45	45
A	46	38	50	24
M	53	18	58	13
J	61	12	66	9
J	68	9	73	7
A	67	9	72	8

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During spring and early summer months, the time when control is being considered, aphid populations can double every two to three weeks if adults produced just one offspring. Since adults normally produce dozens of offspring when temperatures are favorable, population explosions are possible over short periods of time.

Butts (1989) reported that RWA freeze at temperatures between -12 and -16 °F depending on growth stage. He also reported that RWA held at 14 °F for 1, 2 to 4, and more than 5 days, then placed on healthy plants at 50 °F, lived for 26, 11 and less than 7 days, respectively. Individuals exposed to 14 °F for more than 5 days were also unable to reproduce when later expose to favorable temperatures. Exposure to temperatures between 28 and 30 °F at night and above freezing temperatures during the day caused reductions in population. Normal temperature fluctuations in the Columbia Basin during winter months should cause RWA population reductions.

These research findings support many of the observations growers, researchers, and extension personnel have made in the field over the past 5 years.

Economic Thresholds

The following economic thresholds are given in the 1994 Pacific Northwest Insect Control Handbook and are based on results of research and field observations made by research entomologists and extension workers in the Pacific Northwest.

Table 2. Economic thresholds for the Russian wheat aphid

Season	Plant growth stage	Threshold
Fall	seedlings through 1 tiller	10% of plants infested
Fall	larger plants	treat if plants are stressed or danger of winter kill
Spring (winter grain)	green up to first node	5% of plants with reproducing populations and fresh damage
Spring (winter grain)	first node to head emergence	10% of tillers infested
Spring (spring grains)	emergence to head emergence	10% of tillers infested
Spring (all grains)	head emergence to soft dough	treat only if heavy populations (i.e. more than 20 aphids per plant) develop on 10 to 20% of flag leaves or stems
Summer	soft dough and beyond	do not treat

These levels are in close agreement with threshold recommendations given in other western states. Early seedling and early jointing growth stages are when plants are most sensitive to damage. Once tillering has begun in the fall, RWA impact diminishes. Researchers in some areas suggest ignoring levels as high as 40% infested stems in tillered wheat. Field experiments would suggest infestation above 20% can lead to economic damage.

Overwintering populations can increase rapidly. Examine winter wheat fields as early as possible in the spring. Protection of the emerging flag leaf and head is critical. These structures are vital to crop yield and once damaged cannot be replaced.

Field Reality

Table 3 provides background and results for RWA chemical control trials conducted in eastern Oregon by Mike Stoltz and others during 1990 and 1991. Results from four different trials, one with six treatments (Helix 1991), are reported. These trials included both winter and spring wheat applications.

All trials show that while chemical sprays were able to reduce aphid populations, crop yield was generally not positively impacted by the spray. The reason for this may be that the sprays, while effective in reducing aphid numbers, did not reduce populations below economic threshold levels or to a point where population rebound was not possible. In the best case (Pendleton 1990 SWWW-1) the number of infested plants was still 14 percent ten days after treatment. This is well above the 5 percent threshold level established for this time of year in a winter wheat crop. Also, as the treatment was in January, rapid population growth had not yet begun. Even in the spring crop trials with late season sprays, percent infested plants nine days after treatment was 26% at a minimum, 16% above the recommended threshold level. Population resurgence in these trials may also have been due to recolonization of plots by winged aphids from other fields.

Growers and field representatives have reported instances of significant yield increase due to chemical control of RWA. We would speculate that these were instances when aphid populations were reduced to minimal levels.

Should you spray? At this point we do not have the data that would guarantee that a spray is going to be cost effective. We cannot tell you the specific circumstances under which a spray will be effective. We do have data to show that populations above the threshold levels given in Table 2 will cause damage. We do know that the chemicals labeled for use on RWA can kill the insect. The trick would seem to be to figure out how to use the chemicals to reduce populations below threshold levels or below the level where rapid population recovery is possible during critical plant growth stages.

Recommendations

1. Monitor RWA populations carefully. Use repeated sampling in an area to determine how the population is changing over a period of time. Aphid suction traps are located at several experiment stations in eastern Oregon. As of spring 1995, the department of Entomology at Oregon State University assumed responsibility for suction trap monitoring. Suction trap data will be provided to county agents and researchers on an on-going basis. This data can be used to assess RWA flight levels and to assist in making RWA management decisions.

2. As a population nears a threshold level, check the weather. Are temperatures such that rapid population growth is expected or will the population be stable for a period of time. If population stability is likely and you are not in a critical growth stage, wait before taking any action and continue to monitor.

3. When you decide to spray, do everything possible to get maximum knockdown. Research has shown that, in general, ground applications are more precise than aerial. Use maximum water gallonages to increase contact. Use high-end pesticide rates. Kill increases during warm weather. Cold temperatures and rain result in poor control.

4. Experience has shown RWA control in spring crops to be more problematic than in winter crops. Because plant life cycle is shortened, there is less opportunity for recovery from aphid damage. Spring temperatures are favorable for aphid growth and populations can rapidly increase. Winged aphids are often present and sprayed fields can be rapidly recolonized by aphids from other areas.

5. Most oats are resistant to RWA damage. If RWA is an on-going problem for you and oats can be economically grown, this may be an alternative.

6. Gaucho, a new insecticide seed treatment is in the final stages of registration. It has a low human toxicity and is long-lasting. This seed treatment will likely be expensive in comparison to other seed treatments, but may be useful in RWA control, especially in spring crops. More information on this product will be provide to growers if registration is granted.

7. Resistant wheat varieties are being developed for use in the PNW. Use of resistant varieties, once available, will be the key to control.

References

Pike, K.S. and D. Allison. 1991. Russian wheat aphid - biology, damage and management. Idaho, Oregon and Washington Cooperative Extension Services. PNW 371.

Taylor, G.H., D. Schulte, T. Parzuybok, A. Bartlett, C. Scalley. 1993. Climatological data for Oregon agricultural regions. Agric. Expt. Station. Oregon State University. SR912.

1994 Pacific Northwest Insect Control Handbook. p. 190-191. Idaho, Oregon and Washington Cooperative Extension Services.

Table 3. -- Background information and results for RWA chemical control field trials conducted under dryland conditions in eastern Oregon

Trial location	Pendleton	Pendleton	Pendleton
Year	1990	1990	1990
Crop	SWWW	SWWW	SWSW recrop
Type of foliar spray	dimethoate	dimethoate	Lorsban
Spray date	1-10-90	12-5-89	6-5-90
Infestation level at time of spray	75% plts w/symp	30% plts w/sym	60%plts inf
Treatment evaluation date	1-20-90	12-21-89	5-21-90
Control plot ratings on evaluation day	68%sym,24%inf	63%sym,44%inf	--
Treated plot ratings on evaluation day	65%sym,14% inf	53%sym,9%inf	--
Control plot yield (bu/a)	56.7	69.7	3.8
Treated plot yield (bu/a)	54.3	65.7	8.4
PLSD (5%)	NS	NS	2.0
Control plot test weight (lb/bu)	--	59.3	--
Treated plot test weight (lb/bu)	--	59.3	--
PLSD (5%)	--	NS	--

Trial location	Helix	Helix	Helix
Year	1991	1991	1991
Crop	SWSW	SWSW	SWSW
Type of foliar spray	Dimethoate	Disyston	Lorsban
Spray date	5-31-91	5-31-91	5-31-91
Infestation level at time of spray	46% plts inf	46% plts inf	46% plts inf
Treatment evaluation date	6-10-91	6-10-91	6-10-91
Control plot ratings on evaluation day	70% inf	70% inf	70% inf
Treated plot ratings on evaluation day	56% inf	61% inf	50% inf
Control plot yield (bu/a)	39	39	39
Treated plot yield (bu/a)	34	38	42
PLSD (5%)	NS	NS	NS
Control plot test weight (lb/bu)	52	52	52
Treated plot test weight (lb/bu)	53	53	53
PLSD (5%)	NS	NS	NS

Trial location	Helix	Helix	Helix
Year	1991	1991	1991
Crop	SWSW	SWSW	SWSW
Type of foliar spray	Dimethoate	Disyston	Lorsban
Spray date	6-15-91	6-15-91	6-15-91
Infestation level at time of spray	86% plts inf	86% plts inf	86% plts inf
Treatment evaluation date	6-24-91	6-24-91	6-24-91
Control plot ratings on evaluation day	92% inf	92% inf	92% inf
Treated plot ratings on evaluation day	26%	30%	28%
Control plot yield (bu/a)	40	40	40
Treated plot yield (bu/a)	38	39	44
PLSD (5%)	NS	NS	NS
Control plot test weight (lb/bu)	51	51	51
Treated plot test weight (lb/bu)	54	54	53
PLSD (5%)	1	1	1