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Colorado Insecticide Trials for Control of Thrips on Onions 1995-2006

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Abstract

Forty-three trials over a twelve year period are reported that involved evaluation of thrips control resulting from pesticide applications applied to onions. Evaluations included all currently available chemistries for insect control; fungicide and bactericides as well as various adjuvants were also included in these trials. In earlier studies, many pyrethroids, notably lambda-cyhalothrin and zeta-cypermethrin, provided high levels of control. However, in testing during later years all pyrethroids failed to provide control. Marginal effectiveness was observed with some carbamate treatments in some trials (Vydate, Lannate, Carzol) and abamectin, but none of the organophosphates (acephate, oxydemetonmethyl), neonicotinoids (imidacloprid, thiamethoxam), or growth regulators (azadirachtin, fenoxycarb, pyriproxifen) provided control. However, fipronil (Regent) consistently has provided highest levels of control, either as a foliar, transplant dip, or soil treatment. None of the fungicides or bactericides affected thrips populations on onion plants, although in one trial the combination of a fungicide (Bravo 500) with lambda-cyhalothrin decreased control.

Materials Involved in Onion Thrips Trials 1995-2006

Trade Name (active ingredient)	Page(s)
303,630 2SC (experimental insecticide).....	7
A13623 247SC (experimental insecticide).....	31
Actara (thiamethoxam)	22, 25, 31, 34
Actigard (plant defense activator).....	20, 21, 23, 47
Admire 2F (imidacloprid).....	3, 19, 29, 30, 35, 44
Agenda (fipronil)	11
Agri-Mek 0.015E (abamectin).....	14, 25, 26, 27, 31, 34, 38, 40, 41, 42, 43, 45
Assail 70W (acetamiprid).....	34, 41
Avid (abamectin)	15, 22
B-amino butyric acid	23
Bacteriophage (viral pathogen of bacteria).....	23
Bay NTN 293,343 25WG (imidacloprid).....	14
Belay 16WDG (clothianidin).....	30, 35, 44
Biocin (experimental botanical).....	14
BioYield (mixture of plant growth promoting rhizobacteria)	21, 23
BotaniGard 22 WP (<i>Beauveria bassiana</i>)	11, 18
Bravo 720 (chlorothalonil).....	8
BYI-OD (experimental insecticide)	41, 42
BYI-SC (experimental insecticide).....	41, 42
Capture 2E (bifenthrin).....	24
Carzol 80SP (formetanate hydrochloride).....	32, 34, 41, 42, 44, 45
Champ Flowable (fungicide)	8
Cide-Kick (d-limonene).....	8
Clutch (clothianidin).....	25, 34
C-M PowderGard.....	33
Coronatin.....	47
Decis (deltamethrin)	14
Diatomaceous Earth.....	33
Diatect V (pyrethrins, diatomaceous earth).....	33
Diatect IV (pyrethrins, diatomaceous earth).....	26
Diatect II (pyrethrins, diatomaceous earth)	26
Ecozin (azadirachtin)	15, 16
Effersan (chlorine disinfectant)	21, 23
EXP61685B 0.82EC (experimental insecticide)	12, 13
F0579 0.8EW (experimental insecticide)	18
F1785 50DF (experimental insecticide)	22
Fipronil 1.67SC (fipronil).....	3, 4, 7
Flocanimid 50WG.....	25
Fury 1.5E (zeta-cypermethrin).....	7, 16
Guardian (garlic extract).....	4, 8

Hi-Yield Liquid Sulfur (sulfur).....	20
HyperActive (organosilicant spreader).....	20, 25
Karate (lambda-cyhalothrin).....	15, 16
Kinetic (organosilicant spreader).....	1, 2, 6, 8, 41, 42
Knack (pyriproxyfen).....	22, 24
Kocide (copper based bactericide).....	23
Lannate LV (methomyl).....	15, 31, 32, 36, 37, 38, 39, 40, 41, 42, 45
Messenger (harpin protein plant defense activator).....	21, 23
<i>Metarrhizium anisopliae</i> Strain F52.....	18
MetaSystox-R (oxydemetonmethyl).....	15, 16
Methyl jasmonate.....	23, 47
Milsana (botanical plant defense activator).....	21, 23
Mustang 1.5 (zeta-cypermethrin).....	1, 10, 18, 22, 34, 41
Mycotech ES9505 (<i>Beauveria bassiana</i>).....	9
Mycotech WP9503 (<i>Beauveria bassiana</i>).....	9
NAF 85 4SC (spinosad).....	7
Naturalis-O (<i>Beauveria bassiana</i>).....	9
Oberon 2SC (spiromesifan).....	34
Orthene 75S (acephate).....	6, 7
Pantonea agglomerans C9-1.....	21, 23
Piperonyl Butoxide.....	36, 37
Platinum (thiamethoxam).....	19, 28, 29, 30, 35, 44
Precision (fenoxycarb).....	2
Proclaim (enamectin benzoate).....	25, 34
Pyola (pyrethrins + canola oil).....	18
Pyridalyl 35WP (S-1812).....	25
Regent (fipronil).....	2, 25, 26, 27, 28, 29, 30, 32, 34, 35, 43, 44
Spintor 2SC (spinosad).....	12, 13, 14, 15, 16, 18, 20, 25, 34
Success (spinosad).....	11, 22, 27, 41, 43
Surround-at-Home.....	33
TD-2344-02 0.8E (experimental pyrethroid).....	2, 6, 7, 10, 13, 16, 18
TD-2344-03 0.8E (experimental pyrethroid).....	17
TD-2427-01 1.5EC (experimental pyrethroid).....	17
TD-2416-01 0.86EC (experimental pyrethroid).....	17
TennCop (copper-based bactericide).....	8
Thiodan 3E (endosulfan).....	16
Trilogy (neem oil).....	11, 15
Ultiflora (milbemectin).....	25
V-71369 0.86E (pyriproxifen).....	6, 7
Vydate 2 (oxamyl).....	1, 3, 4, 6, 7, 19
Warrior (lambdacyhalothrin).....	1, 2, 4, 6, 7, 8, 10, 12, 13, 14, 15, 16, 17, 18, 20, 22, 24, 25, 26, 27, 31, 32, 34, 36, 37, 38, 40, 41, 42, 43, 45
ZnSO4.....	23

CONTROL OF ONION THRIPS, FT. COLLINS, CO 1995, TRIAL ONE: The experimental site was established at the Colorado State University Department of Horticulture Field Research Center April 29 by seeding into double row beds. Individual plots consisted of single beds, 20-ft in length, arranged in a randomized complete block design with four replications. Applications were applied 20 July and 10 August using a CO₂ compressed air sprayer delivering 20 gal/A at 45 psi, making a single pass along both sides of the plot. Furrow irrigation followed each treatment within 6 hours. Evaluations were made by counting thrips from 10 plants per plot.

Superior control was effected by the pyrethroids Warrior 1E and Mustang 1.5EW. Populations on plots treated with Vydate alone tended to be lower than the control, but were never significant. The Vydate-Warrior treatment was effective.

Treatment and rate	Thrips/plant ¹					
	26 Jul	1 Aug	8 Aug	14 Aug	18 Aug	24 Aug
Warrior 1E 0.02 lb ai/A	1.1 b	5.5 a	25.2 b	5.0 b	5.1 a	9.2 a
Vydate 2E 1 lb ai/A + Kinetic 1.2 oz/A	2.5 b	21.6 a	39.5 ab	7.9 b	18.9 a	13.5 a
Vydate 2E lb ai/A + Warrior 1E 0.02 lb ai/A + Kinetic .2 oz/A fb (10 Aug) Warrior 1E 0.02 lb ai/A	0.8 b	1.1 a	7.8 b	0.5 b	5.5 a	8.8 a
Mustang 1.5EW 0.024 lb ai/A	1.6 b	5.2 a	21.8 b	4.8 b	7.7 a	13.2 a
Mustang 1.5EW 0.0375 lb ai/A	0.9 b	9.4 a	34.5 ab	4.4 b	8.5 a	11.7 a
Mustang 1.5EW 0.05 lb ai/A	0.8 b	3.3 a	34.1 ab	4.8 b	8.2 a	22.9 a
Untreated Check	14.3 a	24.7 a	77.3 a	37.4 a	25.9 a	38.0 a

¹ Numbers within columns followed by the same letter are not significantly different ($P < 0.05$) by SNK test.

CONTROL OF ONION THRIPS, FT. COLLINS, CO 1995, TRIAL TWO: The experimental site was established at the Colorado State University Department of Horticulture Field Research Center April 29 by seeding into double row beds. Individual plots consisted of single beds, 20-ft in length, arranged in a randomized complete block design with four replications. Applications were applied 27 July and 10 August using a CO₂ compressed air sprayer delivering 10.7 gal/A at 45 psi, making a single pass along both sides of the plot. Evaluations were made by counting thrips from 10 plants per plot.

The pyrethroids Warrior 1E and TD2344-02 and Regent 80WG (fipronil) provided a high level of early season control, although persistence of effects of the latter tended to be somewhat shorter. The growth regulator Precision 25W (fenoxycarb) was not effective.

Treatment and rate	Thrips/plant ¹				
	31 Jul	4 Aug	14 Aug	18 Aug	25 Aug
Warrior 1E 0.02 lb ai/A	1.4 b	3.7 a	0.8 c	1.5 a	9.9 a
Regent 80WG 0.025 lb ai/A + Kinetic 1.25 v%/v	6.1 b	20.3 a	2.7 bc	10.9 a	13.3 a
Regent 80WG 0.05 lb ai/A + Kinetic 1.25 v%/v	12.5 ab	22.4 a	2.5 bc	11.3 a	18.4 a
TD2344-02 0.83E 0.24 pt/A	5.3 b	13.0 a	3.8 bc	16.3 a	6.9 a
TD2344-02 0.83E 0.33 pt/A	1.5 b	5.4 a	2.5 bc	12.8 a	16.8 a
Precision 25W 4 oz/A + Kinetic 1.25 v%/v	15.7 ab	19.8 a	15.8 b	27.8 a	11.6 a
Untreated Check	25.9 a	32.4 a	36.3 a	17.3 a	20.5 a

¹ Numbers within columns followed by the same letter are not significantly different (P < 0.05) by SNK test.

EVALUATION OF SOIL TREATMENTS ON CONTROL OF ONION THRIPS ON ONIONS, FT. COLLINS, CO 1996: A trial was established at the Horticulture Field Research Center, Ft. Collins, CO to evaluate the effects of soil treatments on control of onion thrips. Onions (cv. Vega) were transplanted May 14 by placing them in shallow furrows and covering. Prior to covering, Admire and Fipronil treatments were applied; Vydate applications were made May 22 as a drench that was subsequently irrigated. Individual plots were 15 row-ft, arranged in a randomized complete block with five replications. Plots were evaluated by counting thrips on ten plants/plot.

There was a significant reduction in number of onion thrips on Fipronil-treated plots on the first evaluation date (17 June), although this disappeared on later dates. On these latter evaluations there was a trend towards increased thrips numbers on Admire-treated onions.

Treatment and rate	Thrips/plant ¹			
	17 Jun	24 Jun	27 Jun	23 Jul
Admire 2F 1.3 fl oz/1000 row-ft	7.9 a	9.8 ab	13.8 a	33.2 a
Fipronil 80WDG 0.1 lb ai/A	2.0 b	6.9 b	7.0 b	23.6 a
Vydate 2L 2 qt/A	5.7 a	14.2 a	10.5 ab	24.8 a
Untreated Check	8.6 a	9.2 ab	8.9 ab	23.2 a

¹ Numbers within columns followed by the same letter are not significantly different ($P < 0.05$) by Student-Newman-Kuels test.

ONION THRIPS CONTROL, FT. COLLINS, CO 1996: Trials were established using transplanted onions (cv. Vega) in single rows at 30-in spacing. Plots were 25-ft in length arranged in a randomized complete block design with 4 replications. Treatments were applied using a CO₂ compressed air sprayer delivering 18.4 gal/A at 40 psi in two passes directed along the sides of the planting. An organosilicant spreader (Kinetic, 6 fl oz/A) was added to all treatments except the garlic solution (Guardian). Application dates varied among treatments. Evaluations were made by examining 10 plants per plot and counting all thrips present in the neck area of the onions.

Following the first application Fipronil, Warrior and Vydate all significantly suppressed onion thrips for approximately two weeks. Slight reductions in thrips populations also occurred on plants in later evaluations following multiple applications of Guardian (garlic extract).

Treatment and rate	Treatment dates	Thrips/plant ¹				
		6 Jun	11 Jun	17 Jun	24 Jun	27 Jun
Guardian 1.84 gal/A	6/3, 6/13, 6/24, 7/7, 7/20	14.05 a	8.78 a	4.90 b	13.95 c	15.88 cd
Fipronil 1.67SC 0.025 lb ai/A	6/3, 6/24, 7/20	4.33 b	3.50 b	6.10 b	26.95 ab	22.90 c
Fipronil 1.67SC 0.05 lb ai/A	6/3, 6/24, 7/20	1.08 b	1.63 b	2.80 b	17.35 bc	11.08 de
Fipronil 1.67SC 0.068 lb ai/A	6/3, 6/24, 7/20	0.98 b	1.95 b	2.65 b	16.95 bc	13.08 de
Vydate 2 qt/A	6/3, 6/24, 7/20	1.53 b	3.08 b	4.23 b	20.07 abc	31.78 b
Vydate 3 pts						
+ Warrior 0.02 lb ai/A	6/14, 6/24, 7/20	11.83 a	2.40 b	1.05 b	2.93 d	2.63 e
Warrior 1E 0.02 lb ai/A	6/24, 7/20	11.33 a	3.68 b	16.02 a	30.08 a	5.98 de
Warrior 1E 0.02 lb ai/A	6/3, 6/24, 7/20	0.95 b	1.65 b	1.53 b	9.30 cd	3.30 e
Untreated Check		10.55 a	3.68 b	15.13 a	27.30 ab	40.10 a

CONTROL OF ONION THRIPS, FT. COLLINS, CO 1996...Continued:

Treatment and rate	Treatment dates	Thrips/plant ¹			
		2 Jul	12 Jul	23 Jul	1 Aug
Guardian 1.84 gal/A	6/3, 6/13, 6/24, 7/7, 7/20	46.50 b	45.65 a	10.63 b	0.83 a
Fipronil 1.67SC 0.025 lb ai/A	6/3, 6/24, 7/20	42.95 bc	31.95 a	8.80 b	1.13 a
Fipronil 1.67SC 0.05 lb ai/A	6/3, 6/24, 7/20	33.10 cd	28.83 a	7.00 b	0.85 a
Fipronil 1.67SC 0.068 lb ai/A	6/3, 6/24, 7/20	29.90 d	38.43 a	6.53 b	1.15 a
Vydate 2 qt/A	6/3, 6/24, 7/20	48.43 b	44.30 a	5.10 b	0.80 a
Vydate 3 pts + Warrior 0.02 lb ai/A	6/14, 6/24, 7/20	10.93 e	33.85 a	4.58 b	0.75 a
Warrior 1E 0.02 lb ai/A	6/24, 7/20	12.58 e	34.08 a	3.50 b	0.65 a
Warrior 1E 0.02 lb ai/A	6/3, 6/24, 7/20	9.18 e	28.38 a	8.45 b	0.45 a
Untreated Check		63.43 a	41.15 a	19.05 a	1.38 a

¹ Numbers within columns followed by the same letter are not significantly different (P < 0.05) by Student-Newman-Kuels test.

ONION THRIPS CONTROL, FT. COLLINS, CO 1996: Trials were established using transplanted onions (cv. Vega) in single rows at 30-in spacing. Plots were 25-ft in length arranged in a randomized complete block design with 4 replications. Treatments were applied on two dates (14 June, 7 Jul) using a CO₂ compressed air sprayer delivering 18.4 gal/A at 30 psi in two passes directed along the sides of the planting. An organosilicant spreader (Kinetic, 6 fl oz/A) was added to all treatments. Application dates varied among treatments. Evaluations were made by examining 10 plants per plot and counting all thrips present in the neck area of the onions.

All treatments provided significant control after the first application, with the pyrethroids TD-2344-02 and Warrior showing the longest persistence.

Treatment and rate	Thrips/plant ¹						
	17 Jun	24 Jun	2 Jul	11 Jul	19 Jul	25 Jul	1 Aug
TD-2344-02 0.8E 4 fl oz	1.8 b	5.3 b	19.8 c	19.1 b	9.1 c	26.9 a	3.1 ab
TD-2344-02 0.8E 5.6 fl oz	9.8 b	6.4 b	23.9 c	16.4 b	6.0 c	19.3 a	3.0 ab
Orthene 75S 1.0 lb ai/A	1.2 b	14.1 b	40.8 b	26.3 b	7.0 c	15.8 a	0.8 b
Orthene 75S 1.0 lb ai/A + V-71369 0.86E 50 gr ai/A	2.0 b	10.2 b	43.4 b	14.5 b	8.6 c	23.5 a	5.0 a
V-71369 0.86E 50 gr ai/A	9.4 a	13.8 b	55.9 ab	52.6 a	19.7 b	16.2 a	1.8 ab
Warrior 1E 0.02 lb ai/A	1.0 b	4.0 b	22.2 c	11.8 b	7.6 c	18.7 a	2.3 ab
2Vydate 2L 3 pts fb Warrior 1E 0.02 lb ai/A	5.1 b	13.1 b	56.2 ab	10.8 b	5.6 c	17.8 a	1.5 ab
2Warrior 1E 0.02 lb ai/A fb Vydate 3 pts	1.2 b	4.8 b	17.7 c	22.7 b	12.0 c	19.9 a	1.5 ab
Untreated Check	10.0 a	24.7 a	60.6 a	58.0 a	34.2 a	24.3 a	1.7 ab

¹ Numbers within a column followed by the same letter are not significantly different ($P < 0.05$) by SNK.

² Vydate/Warrior treatments involved alternating the two insecticides between the two application dates.

ONION THRIPS CONTROL, FRUITA, CO 1996: Trials were established using seeded onions (cv. Brown Beauty) in single rows at 30-in spacing. Plots were 20-ft in length arranged in a randomized complete block design with 4 replications. Treatments were applied June 20 and July 11 using a CO₂ compressed air sprayer delivering 19.2 gal/A at 40 psi in two passes directed along the sides of the planting. Evaluations were made by examining 10 plants per plot and counting all thrips present in the neck area of the onions.

Pest pressure was heavy at the site. Pyrethroid insecticides (Warrior, Mustang, TD-2344-2) provided the most consistent control.

Treatment and rate	Thrips/plant ¹					
	5 Jun	2 Jul	9 Jul	16 Jul	23 Jul	30 Jul
Warrior 1E 3.54 fl oz/A	11.6 d	19.6 bc	142.4 a	11.0 d	8.7 b	28.1 a
Fury 1.5EW 0.0375 lb ai/A	10.8 d	12.5 c	113.1 ab	20.6 d	5.5 b	11.9 a
NAF-85 4SC 50 ppm	58.2 a	31.4 bc	62.8 b	64.6 abc	59.8 a	19.3 a
NAF-85 4SC 200 ppm	36.0 bc	41.7 abc	72.8 b	48.6 abcd	48.3 ab	26.8 a
TD-2344-02 0.8E 5.6 fl oz/A	14.8 cd	22.4 bc	75.6 b	11.7 d	10.0 b	38.7 a
Orthene 75S 1.0 lb ai/A	36.5 bc	43.6 abc	72.6 b	40.1 bcd	21.4 ab	44.7 a
V-71369 0.86E 50 gr ai/A	37.7 b	50.3 ab	86.7 b	72.5 ab	20.8 ab	28.2 a
Vydate 2L 3 pts/A	32.9 bc	22.7 bc	70.8 b	25.0 cd	27.9 ab	30.2 a
Fipronil 1.67SC 0.05 lb ai/A	25.0 bcd	16.0 bc	66.2 b	19.2 d	15.1 ab	47.9 a
303,630 2SC 0.15 lb ai/A	28.4 bcd	25.3 bc	56.7 b	13.5 d	22.2 ab	14.2 a
303,630 2SC 0.25 lb ai/A	33.8 bc	22.3 bc	102.9 ab	35.0 bcd	44.3 ab	10.6 a
Untreated Check	38.4 b	65.1 a	66.7 b	84.5 a	41.4 ab	29.5 a

¹ Numbers followed by the same letter are not significantly different (P < 0.05) by SNK.

EVALUATION OF ADJUVANTS AND CO-APPLIED PESTICIDES ON CONTROL OF ONION THRIPS, ROCKY FORD, CO 1996: The trial was conducted at the Arkansas Valley Research Center on seeded onions (cv. Mambo) planted in double-row beds at 36-in centers. Plots consisted on a single row of bed, 20-ft in length and were arranged in a randomized complete block with three replications. Treatments were applied 8 July using a CO₂ compressed air sprayer delivering 24 gal/A at 35 psi. Evaluations were made 16 July by counting all thrips on ten plants in the center of each plot.

None of the adjuvants (Kinetic, Cide-Kick) provided improved control of onion thrips when used with the pyrethroid Warrior (lambda-cyhalothrin). Co-application of Warrior with the fungicide Bravo 720 significantly reduced control of onion thrips. Co-application with the bactericides Champ Flowable or Tennocop did not reduce thrips control. Guardian (garlic-based insecticide) was not effective.

Treatment and rate	Thrips/plant ¹
Guardian 2.4 gal/A (10% v)	67.1 a
Bravo 720 3 pt + Warrior 1E 0.015 lb ai/A	56.7 abc
Guardian 2.4 gal/A + Warrior 1E 0.015 lb ai/A	48.8 abcd
Champ Flowable 1.33 pt + Warrior 1E 0.015 lb ai/A	46.8 bcd
Kinetic 6 fl oz/A + Warrior 1E 0.015 lb ai/A	39.0 cd
Tennocop 3 pt + Warrior 1E 0.015 lb ai/A	39.0 cd
Warrior 1E 0.015 lb ai/A	33.0 d
Warrior 1E 0.02 lb ai/A	32.1 d
Cide-Kick 1 pt + Warrior 1E 0.015 lb ai/A	30.5 d
Untreated Check	64.1 ab

¹ Numbers within a column followed by the same letter are not significantly different (P < 0.05) by SNK test.

CONTROL OF ONION THRIPS USING *BEAUVERIA BASSIANA* FORMULATIONS, FT. COLLINS, CO, 1996: Trials were conducted at the Horticulture Field Research Center of Colorado State University to evaluate two *Beauveria bassiana* formulations for the control of onion thrips on onions. Individual plots consisted of two rows of transplanted onions (cv. 'Vega') arranged in single row beds, at 30-inch spacing, 5-ft in length with a 2-ft buffer between plots. Plot design was a randomized complete block design with four replications. During each application an equivalent of 1273 l/ha, including the wetting agent Silwet, was applied using a hand operated pump mister, that allowed thorough wetting of the foliage. Applications were made 21 June, 5 July, and 17 July. Evaluations were made by counting all thrips on 6 plants/plot.

No significant control of onion thrips was observed by any of the treatments in this trial.

Treatment and rate/liter applied solution ²	Thrips/6 plants ¹		
	24 Jun	12 Jul	23 Jul
Naturalis-O 7.8 ml/l	177.8 a	154.3 a	171.8 a
Mycotech ES9505 4.6 ml/l	128.5 a	121.0 a	165.5 a
Mycotech WP9503 2.2 gr/l	127.0 a	122.0 a	233.0 a
Water Check	130.8 a	136.0 a	160.3 a

¹ Average of 4 replications. Numbers followed by the same letter within a column are not significantly different ($P < 0.05$) by SNK.

² All treatments, except the water check, included the addition of 0.4 ml Silwet/l as a wetting agent. Rates were applied in the equivalent of 1273 l/ha.

CONTROL OF ONION THRIPS WITH PYRETHROID INSECTICIDES, FT. COLLINS, CO 1997: Trials were conducted at the Horticulture Field Research Farm north of Ft. Collins, CO on transplant onions (cv. Tango). Individual plots consisted of 25-ft of double row bed and with experimental design a randomized complete block with four replications. Applications were made 16 June and 27 June using a CO₂ compressed air sprayer delivering 18 gal/A as a double pass directed at the side of the plots. Evaluations were made by examining 10 plants in the center of each plot and counting all thrips found in the neck area.

All treatments were able to significantly suppress thrips populations for over 10 days after applications.

Treatment and rate/Acre	Thrips/plant ¹					
	18 Jun	20 Jun	26 Jun	30 Jun	8 Jul	16 Jul
Mustang 1.5EW 0.0375 lbs ai	0.9 bc	2.1 b	3.7 b	1.2 b	4.8 ab	11.1 a
Mustang 1.5EW 0.045 lbs ai	1.1 bc	2.1 b	4.9 b	0.4 b	3.3 b	9.1 a
TD-2344-02 0.8E 0.04 lbs ai	1.9 b	3.3 b	5.5 b	0.9 b	3.9 ab	6.9 a
TD-2344-02 0.8E 0.03 lbs ai	0.5 c	2.2 b	4.8 b	0.6 b	4.4 ab	9.7 a
Warrior 1E 0.015 lbs ai	1.1 bc	1.8 b	3.9 b	0.8 b	1.7 b	8.4 a
Untreated Check	8.3 a	12.9 a	10.9 a	26.7 a	20.5 a	15.5 a

¹ Original data. Analysis for all dates, except 16 July, based on log transformed means. Numbers within a column followed by the same letter are significantly different ($P < 0.05$) by SNK.

CONTROL OF ONION THRIPS, FOLIAR TRIAL TWO, FT. COLLINS, CO 1997:

Trials were conducted at the Horticulture Field Research Farm north of Ft. Collins, CO on transplant onions (cv. 'Vega'). Trials involved small plots, 14-ft long beds, with experimental design a randomized complete block with four replications. Only a single application was made, 3 July, using a CO₂ compressed air sprayer delivering 15 gal/A as a single pass over the top of the plants. Evaluations were made by examining 10 plants in the center of each plot and counting all thrips found in the neck area.

No significant control was observed 5 DAT. There was a modest suppression of onion thrips populations 12 DAT from fipronil (Agenda), spinosad (NAF-315) and *Beauveria bassiana* (BotaniGard). Neem oil (Trilogy) was ineffective. All treatment differences had disappeared by 19 DAT. No phytotoxicity was evident.

Treatment and rate	Onion thrips/plant ¹		
	8 Jul	15 Jul	22 Jul
Success (NAF-315) 8 fl oz/A	50.50 a	35.50 b	104.75 a
Success (NAF-315) 8 fl oz/A + Kinetic 6 fl oz/100 gal	38.50 a	20.00 b	105.75 a
BotaniGard (WP9616B) 1 lb/A	53.50 a	32.50 b	129.00 a
BotaniGard (WP9616B) 1 lb/A + Kinetic 6 fl oz/100 gal	112.00 a	60.50 b	204.33 a
Trilogy 1 gal/100 gal	73.75 a	44.75 ab	85.25 a
Agenda 1.67SC 0.05 lb ai/A	63.50 a	17.50 b	88.25 a
Untreated Check	126.00 a	128.25 a	89.50 a

¹ Data log transformed for analysis; original data presented. Numbers within a column that are not followed by the same letter are significantly different (P < 0.05) by SNK.

CONTROL OF ONION THRIPS, FT. COLLINS, CO, TRIAL TWO 1998: Trials were conducted at the Horticulture Field Research Farm, north of Ft. Collins, CO on transplanted onions. Plots consisted of single rows, 23-ft in length and were arranged in a randomized complete block design with four replications. Applications were made 8 July using a flat fan spray directed at both sides of the row with a CO₂ compressed air sprayer in 36 gal/A. Evaluations were made by counting all thrips on ten plants in the center of each plot.

Only the pyrethroid lambda-cyhalothrin (Warrior) provided significant control at 2 DAT. None of the treatments provided control at 8 DAT.

Treatment and rate/A	Thrips/plant ¹	
	10 Jul	16 Jul
Spintor 16 fl oz	13.9 ab	29.8 a
Spintor 16 fl oz + Kinetic 0.1%	10.9 ab	33.6 a
Warrior 1E 0.015 lbs ai	8.9 b	24.4 a
EXP61685B 0.82EC 16 fl oz	21.4 ab	37.5 a
EXP61685B 0.82EC 32 fl oz	25.7 a	35.9 a
Untreated Check	26.4 a	34.6 a

¹ Average of ten plants/plot. Numbers within a column that are not followed by the same letter are significantly different ($P < 0.05$) by SNK.

CONTROL OF ONION THRIPS, FT. COLLINS, CO TRIAL ONE 1998: Trials were conducted at the Horticulture Field Research Farm, north of Ft. Collins, CO on transplanted onions ('Vega'). Plots consisted of single rows, 23-ft in length and were arranged in a randomized complete block design with four replications. Applications were made 25 June using a flat fan spray directed at both sides of the row with a CO₂ compressed air sprayer in 36 gal/A. Evaluations were made by counting all thrips on ten plants in the center of each plot.

The pyrethroids zeta-cypermethrin (TD-2344-0) and lambda cyhalothrin (Warrior) provided greatest thrips suppression 4 DAT. A lesser of control was effected by spinosad (Spintor). At 7 DAT only Warrior and the high rate of TD-2344-02 produced significantly lower numbers of thrips/plant.

Treatment and rate	Thrips/plant ¹	
	29 Jun	2 Jul
TD-2344-02 0.8E 0.0375 lb ai	29.5 b	131.0 a
TD-2344-02 0.8E 0.045 lb ai	18.3 b	61.0 b
Warrior 1E 0.015 lbs ai	16.3 b	58.3 b
Spintor 10 fl oz	40.3 b	143.8 a
EXP61685B 0.82EC 5 fl oz 0.78	94.3 a	200.8 a
Untreated Check	87.3 a	159.3 a

¹ Average of ten plants/plot. Numbers within a column that are not followed by the same letter are significantly different (P < 0.05) by SNK.

CONTROL OF ONION THRIPS, FT. COLLINS, CO 1999: Trials were conducted at the Horticulture Field Research Farm, north of Ft. Collins, CO on transplanted onions ('Whitekeeper'). Plots consisted of single rows, 25-ft in length and were arranged in a randomized complete block design with four replications. Applications were made 23 June and 22 July using a flat fan spray directed at both sides of the row with a CO₂ compressed air sprayer in 36 gal/A. Evaluations were made by sampling all thrips on ten plants in the center of each plot.

Among the pyrethroids, lambda-cyhalothrin (Warrior) provided most consistent control, deltamethrin (Decis) provided marginal control. Slight activity was observed with SpinTor (spinosad) and Agri-Mek (abamectin).

Treatment and rate	Thrips/plant ¹			
	29 Jun	7 Jul	13 Jul	26 Jul
Decis 0.2 0.19 oz ai/A	19.9 ab	6.9 ab	83.7	38.3 ab
Decis 0.2 0.27 oz ai/A	13.5 b	4.4 b	77.1	25.8 cd
Decis 0.2 0.35 oz ai/A	12.8 b	4.8 b	75.8	33.5 cd
Decis 0.2 0.45 oz ai/A	12.2 b	4.6 b	79.7	24.3 cd
Biocin 7.5% v:v	25.4 a	7.7 a	73.4	64.5 ab
Agri-Mek 0.15 12 oz	18.0 ab	4.4 b	68.1	33.1 cd
Warrior 1E 0.015 lbs ai	1.5 c	1.7 c	55.5	6.1 d
Spintor 10 fl oz	13.9 ab	4.9 b	72.6	12.8 cd
Bay 293,343 25WG 4 oz	14.5 ab	7.4 a	74.2	77.6 a
Bay 293,343 25WG 8 oz	20.8 ab	6.9 ab	76.6	52.5 ab
Untreated Check	25.7 a	7.4 a	77.4	60.3 ab

¹ Average of 40 plants (4 replications). Numbers within a column not followed by the same letter are significantly different (P < 0.05) by SNK.

CONTROL OF ONION THRIPS ON BULB ONIONS, ROCKY FORD, CO 2000: Trials were conducted at the Arkansas Valley Research Center, in Rocky Ford, CO on seeded onions established in double-row beds at spacing of 36-in centers. Plots consisted of 26-ft of the bed and were arranged in a completely randomized design with 4 replications. Treatments were applied June 20 and retreated July 5 using a CO₂ compressed air sprayer directed over the top of the plants. An additional application of Ecozin was made June 28. All treatments included the wetting agent Kinetic (0.05% v:v). Evaluations were made by counting all thrips in 10 plants in the center of each plot.

Greatest control resulted from applications including lambda-cyhalothrin (Warrior, Karate), alone or in combination. Modest suppression was observed on the July 5 evaluation from applications of spinosad (Spintor) and abamectin (Avid). No phytotoxicity was observed following any treatment.

Treatment and rate	Thrips/plant ¹		
	28 Jun	5 Jul	14 Jul
Warrior T 3.2 fl oz/A	14.6 bc	11.3 bc	4.0
Karate 1E 3.2 fl oz/A	15.7 bc	12.7 bc	4.8
Metasystox-R 3 pts/A	41.7 ab	35.9 abc	34.8
Metasystox-R 1.5 pts/A + Warrior T 3.2 fl oz/A	14.4 bc	10.3 bc	5.5
Spintor SC 8 fl oz/A	33.3 abc	23.8 bc	9.5
Ecozin 8 fl oz/A+ Trilogy 1.0% v:v	52.5 a	40.5 ab	38.6
Lannate LV 3 pts/A	37.1 abc	36.2 abc	19.9
Lannate LV 3 pts/A + Warrior T 3.2 fl oz	7.7 c	7.0 c	5.6
Avid 6 fl oz	35.2 abc	24.6 bc	12.8
Untreated Check	54.6 a	63.6 a	32.8 n.s.

¹ Numbers within the same column that are not followed by the same letter are significantly different (P < 0.05) by SNK.

CONTROL OF ONION THRIPS ON BULB ONIONS, TRIAL ONE, FT. COLLINS, CO 2000: Trials were conducted at the Horticulture Field Research Center, north of Ft. Collins on onions ('Bravo') transplanted May 15. Individual plots consisted of a single 25-ft double row bed, spaced at 30-in centers and were arranged in a completely randomized design with 4 replications. Insecticides were applied June 23 and July 7 by use of a CO₂ compressed air sprayer delivering 25 gal/A. Sprayers involved a flat fan nozzle and were directed at the outside of each row. All treatments included a wetting agent: Silwet 0.05% v:v during the first treatment; Kinetic 0.05% v:v during the second application. An additional application of Ecozin was made June 30. Evaluations were made by counting all thrips in ten plants in the center of each plot.

Thrips populations were moderately high, peaking at slightly more than 20 thrips/plant. Greatest persistence of effect was achieved with treatments including lambda-cyhalothrin (Warrior, Karate) and endosulfan (Thiodan). There was no evidence of phytotoxicity from any treatment.

Treatment and rate	Thrips/plant ¹				
	29 June	7 Jul	10 Jul	14 Jul	21 Jul
Warrior T 3.2 fl oz/A	3.3 cde	11.6 abc	4.2 bc	6.4 c	8.9 b
Karate 1E 3.2 fl oz/A	1.4 e	8.3 c	3.3 cd	4.3 c	7.0 b
Metasystox-R 3 pts/A	9.0 bcd	18.4 ab	9.0 abc	14.8 ab	19.0 ab
Metasystox-R 1.5 pts/A + Warrior T 3.2 fl oz/A	1.3 e	9.0 c	3.8 cd	7.3 c	9.9 b
Spintor SC 10 fl oz	9.7 bc	14.3 abc	6.1 cd	8.2 bc	12.8 b
Thiodan 3EC 1 1/3 qts/A	1.9 de	8.9 c	2.4 d	7.6 c	9.3 b
Fury 1.5EC 4.26 fl oz/A	4.8 bcde	20.8 ab	3.5 cd	4.9 c	9.1 b
TD-2344-02 0.83EC 0.03 lbs ai/A	5.1 bcde	18.5 ab	8.0 bcd	14.9 ab	25.4 a
Ecozin 8 fl oz + 1% Trilogy	11.9 b	20.8 ab	15.2 a	18.0 a	29.1 a
Untreated Check	21.5 a	21.4 a	12.9 ab	7.1 c	8.2 b

¹ Numbers within a column not followed by the same letter are significantly different ($P < 0.05$) by LSD t Grouping analysis.

CONTROL OF ONION THRIPS ON BULB ONIONS, TRIAL TWO, FT. COLLINS, CO 2000: Trials were conducted at the Horticulture Field Research Center, north of Ft. Collins on onions (cv. 'Bravo') transplanted May 15. Individual plots consisted of a single 18-ft single row bed, spaced at 30-in centers and were arranged in a completely randomized design with 4 replications. Insecticides were applied June 30 and July 13 by use of a CO₂ compressed delivering 25 gal/A. Sprayers involved a flat fan nozzle and were directed at outside of each row. All treatments included Kinetic 0.05% v:v as a wetting agent. Evaluations were made by counting all thrips in ten plants in the center of each plot.

Warrior, TD-2344-03 and TD-2427-1 provided moderate control following the first application but only Warrior provided significant control following the second application. TD-2416-01 gave unusual results with the mid-rate performing less well than the higher and lower tested rates. None of the treatments produced observable phytotoxicity.

Treatment and rate	Thrips/plant ¹					
	3 Jul	7 Jul	13 Jul	19 Jul	24 Jul	28 Jul
TD-2344-03 0.83EC 0.03 lb ai/A	4.9 b	13.3 bc	10.5	9.0 bc	8.5 b	7.8
TD-2427-01 1.5EC 0.03 lb ai/A	5.1 b	12.9 bc	10.7	12.6 bc	10.4 b	7.7
TD-2416-01 0.86EC 0.025 lb ai/A	7.8 ab	17.6 a	16.7	16.4 bc	14.5 b	7.1
TD-2416-01 0.86EC 0.03 lb ai/A	10.5 a	16.9 ab	22.9	26.6 a	28.5 a	8.9
TD-2416-01 0.86EC 0.035 lb ai/A	7.6 ab	18.8 a	19.1	14.2 bc	14.6 b	7.4
Warrior T 1ME 0.02 lb ai/A	4.8 b	11.7 c	17.6	8.6 c	9.0 b	6.9
Untreated Check	11.8 a	15.5 abc	16.8 n.s.	17.2 b	18.7 ab	7.9 n.s.

¹Numbers within a column that are not followed by the same letter are significantly different (P < 0.05) by F-protected LSD test.

CONTROL OF ONION THRIPS, FT. COLLINS, CO 2001: Trials were conducted at the Colorado State University Horticulture Research Center, north of Ft. Collins CO. Experimental plots consisted of transplanted onions ('Vega') arranged in single rows, 25-ft in length arranged in a completely randomized design with four replications. Applications were made 4 July and 18 July using a CO2 compressed air sprayer delivering 20 gal/A over the top of the onions. Treatments were evaluated by counting all thrips on 10 randomly selected onions in the center of each plot.

The pyrethroids Warrior and Mustang provided good control in early evaluations but not in later ones. On a single evaluation date, the *Metarrhizium anisopliae* product showed interesting activity.

Treatment and rate	Thrips/plant ¹				
	5 Jul	12 Jul	18 Jul	25 Jul	8 Aug
BotaniGard 22 WP 1 lb/A	25.4 a	31.0 a	19.7 a	21.6 ab	7.9 a
Warrior T 3.2 fl oz/A	5.3 cd	7.0 d	16.0 a	39.5 a	21.6 a
<i>Metarrhizium anisopliae</i> F52 2 ml/l	25.1 ab	24.5 ab	12.8 a	4.2 c	21.5 a
Pyola 2 tsp/qt	17.3 bc	30.1 a	16.9 a	19.3 ab	27.5 a
Spintor 10 fl oz/A	6.8 cd	21.5 abc	15.6 a	18.4 ab	18.5 a
Mustang 1.5 4.26 fl oz/A	4.4 cd	8.6 cd	12.4 a	14.0 ab	33.9 a
F0579 0.8EW 0.025 lb ai/A	4.3 cd	13.2 bcd	11.2 a	9.6 ab	35.2 a
F0579 0.8EW 0.017 lb ai/A	3.3 d	12.9 bcd	11.6 a	21.2 ab	24.1 a
TD-2344-02 0.83E 0.03 lbs/A	9.1 cd	21.0 abc	13.4 a	12.9 b	11.5 a
Untreated Check	30.7 a	30.4 a	18.0 a	17.9 ab	17.2 a

¹ Numbers in the same column not followed by the same letter are significant (P < 0.05) by SNK.

EVALUATION OF PLANTING TIME TREATMENTS ON CONTROL OF ONION THRIPS, 2002: 'Yula' onions were transplanted 11 April to single rows, at 32-in centers. Individual plots were 12 row-ft and experimental design was completely randomized with 5 replications. Applications were applied as a 4-in sprayed band over the onion transplants in a shallow trough, and the onions were immediately covered.

Treatment and rate	Thrips/plant ¹		
	28 May	11 Jun	20 Jun
Platinum 0.62 fl oz/1000 row-ft	1.12 a	4.64 a	14.06 a
Admire 1.3 fl oz/1000 row-ft	0.88 a	4.92 a	13.86 a
Vydate L 1 gal/A	0.68 a	3.34 a	12.02 a
Untreated Check	1.50 a	7.16 a	12.48 a

¹ No treatments significantly different ($P < 0.05$).

CONTROL OF ONION THRIPS, FOLIAR TRIAL, 2002: Trials were conducted at the Colorado State University Horticulture Research Center, north of Ft. Collins, CO. 'Yula' onions were transplanted 11 April to single rows. Plots were single beds, 25-ft in length, arranged in a completely randomized design with four replications. Applications were made with a flat fan nozzle delivering 20 gal/A over the top of the plants. Evaluations were made by counting all thrips on 10 plants/plot.

Low thrips pressure was present in this trial. Addition of adjuvants (Hyperactive, Hi-Yield Liquid Sulfur), Spintor or Actigard were included in these trials but differences could not be distinguished from the treatments.

Treatment and rate	Treatment dates	Thrips/plant ¹					
		11 Jun	20 Jun	28 Jun	3 Jul	9 Jul	12 Jul
Warrior T 3.2 fl oz	31 May, 27 Jun, 10 Jul	1.3	11.0	5.6	8.7	6.3	4.5
Warrior T 3.2 fl oz	27 Jun, 10 Jul			2.2	8.5	9.1	4.2
Warrior T 3.2 fl oz	10 Jul			18.4	23.9	9.2	3.0
Warrior T 3.2 fl oz and Hyperactive (0.25% v/v)	27 Jun, 10 Jul			7.2	8.0	7.7	5.8
Warrior T and Sulfur 1 pt/A	27 Jun, 10 Jul			8.8	9.3	8.8	3.3
Warrior T 3.2 fl oz and Spintor 10 fl oz	27 Jun, 10 Jul			4.9	12.2	4.0	3.0
Warrior T 3.2 fl oz and Actigard 3/4 oz	27 Jun, 10 Jul			7.5	7.1	7.7	3.6
Actigard 3/4 oz	27 Jun, 10 Jul			17.6	27.0	12.4	10.6
Untreated Check		14.0	17.0	18.9	29.5	10.6	10.2

¹ No treatment differences ($P < 0.05$) were detected on any sampling date.

EVALUATIONS OF ALTERNATIVE DISEASE CONTROL PRODUCTS ON ONION

THRIPS, 2002: Evaluations were made of onion thrips on plots (Schwartz, Gent²) involved in the evaluations of plant disease treatments. Cultivars involved were 'Vantage' at ARDEC and 'X202' at the Arkansas Valley Research Center. Plot design at both sites were randomized complete block with four replications. On each sample date, thrips assessments were made on 10 plants in the center of each plot. All thrips on each plant were counted. Prior to sampling at ARDEC, applications had been made July 8, 29, August 5. Applications at Rocky Ford had been made July 1 and 8 prior to the single July 11 sampling. Applications were applied in 25 gal/A.

None of the treatments affected thrips populations on plants.

Treatment and rate	Thrips/plant ¹		
	ARDEC		Rocky Ford
	31 Jul	12 Aug	11 Jul
Messenger 6 oz/A	3.8	18.0	9.7
Actigard 0.75 oz/A	3.8	18.5	21.8
Milsana 1 pt/A	4.5	15.1	8.7
BioYield (PGPR) 1% v:v	5.3	20.6	15.5
<i>Pantonea agglomerans</i> C9-1 10 ⁸ cfu/ml	14.3	20.3	
Efferson 200 ppm	4.8	21.6	13.3
Untreated Check	3.7	15.4	16.9

¹ No significant differences (P < 0.05) were observed on any sample date.

² These trials were conducted by Howard Schwartz and David Gent who took associated data on disease control and yield.

CONTROL OF ONION THRIPS, ROCKY FORD, CO 2003: Trials were conducted at the Arkansas Valley Research Center, Rocky Ford, CO. Plots consisted of seeded onions (X202, Waldo Seeds) in a single, double-row bed on 3.5-ft centers, 30-ft in length. Experimental design was randomized complete block with 4 replications. Applications were made June 24 in a volume of 60 gal/A. Evaluations were made July 2 by counting all thrips on 10 plants in the center of each plot.

Thrips pressure was low in this trial. During the single evaluation all treatments caused some significant suppression of thrips on plants.

Treatment and rate/A	Thrips/plant ¹
Warrior 3.8 fl oz + Success 10 fl oz	3.48 c
Warrior 3.8 fl oz + Actara 25WDG 4 oz	4.83 bc
Warrior 3.8 fl oz + Knack 10 fl oz	5.33 bc
Mustang 4 fl oz	5.90 bc
Warrior 3.8 fl oz	6.08 bc
Success 10 fl oz	6.38 bc
F1785 50DF 10 oz	6.98 bc
Warrior 3.8 fl oz + Avid 0.15EC 6 fl oz	7.63 bc
Knack 10 fl oz	7.90 bc
Avid 0.15EC 6 fl oz	8.08 bc
Actara 25 WDG 4 oz	9.18 b
Untreated Check	12.08 a

¹ Numbers within a column not followed by the same number are significantly different (P < 0.05) by SNK.

EVALUATIONS OF ALTERNATIVE DISEASE CONTROL PRODUCTS ON ONION

THRIPS, 2003: Evaluations were made of onion thrips on plots (Schwartz, Gent²) involved in the evaluations of plant disease treatments. 'Vantage' was direct seeded at ARDEC and plot design was randomized complete block with four replications. On each sample date, thrips assessments were made on 10 plants by counting all thrips on each plant. Prior to sampling, applications had been made July 13, 20, 27, August 3 and 9. Applications were applied in 25 gal/A.

No treatments produced differences in numbers of thrips on plants. The effect of methyl jasmonate appeared to flip, resulting in lowest numbers of thrips in the first (3 Aug) evaluation and highest numbers in the second (22 Aug) evaluation.

Treatment and rate	Thrips/plant ¹	
	3 Aug	22 Aug
Kocide 2000 1.5 lb/A	18.2 a	24.6 ab
Messenger 8 oz/A	18.2 a	13.9 b
ZnSO ₄ 1.0 lb/A	17.6 a	26.1 a
Actigard 0.75 oz/A	17.6 a	27.3 a
Milsana 1 pt/A	16.3 a	25.0 ab
BioYield (PGPR) 32 oz/A	13.8 ab	17.6 ab
<i>Pantonea agglomerans</i> C9-1 10 ⁸ cfu/ml	15.4 ab	27.9 a
Efferson 400 ppm	11.8 ab	23.1 ab
Bacteriophage 10 ⁸ pfu/ml	10.9 ab	22.9 ab
B-amino butyric acid 100mM	18.6 a	21.6 ab
Methyl jasmonate 100 mM	6.7 b	28.8 a
Untreated Check	15.8 ab	22.1 ab

¹ Numbers within a column not followed by the same number are significantly different (P < 0.05) by SNK.

² These trials were conducted by Howard Schwartz and David Gent who took associated data on disease control and yield.

CONTROL OF ONION THRIPS, FT. COLLINS, CO 2003: Trials were conducted on transplant onions ('Candy') at the Horticulture Field Research Center north of Ft. Collins, CO. Plots consisted of transplanted onions in a single-row bed on 2.5-ft centers, 30-ft in length. Experimental design was randomized complete block with 4 replications. Applications were made June 29 and July 6. Applications were made with a CO₂ compressed air sprayer delivering 38 gal/A and the adjuvant Hyperactive was included in all sprays at 0.5% v:v. Evaluations were made by counting all thrips on 10 plants in the center of each plot.

Treatment and rate/A	Thrips/plant ¹	
	July 2	July 10
Warrior CS 3.8 fl oz	18.8 ab	60.9
Knack 10 fl oz	20.9 ab	54.1
Warrior + Knack 10 fl oz	17.6 ab	45.9
Capture 2EC 4.8 fl oz	13.2 b	32.5
Untreated Check	22.1 a	47.3 n.s.

¹ Numbers within a column not followed by the same number are significantly different ($P < 0.05$) by SNK.

CONTROL OF ONION THRIPS, TRIAL ONE, FT. COLLINS, CO 2004: Trials were conducted on transplant onions at the Agriculture Research Demonstration and Education Center north of Ft. Collins, CO. Plots consisted of two double-row beds on 25-ft centers, 25-ft in length. Experimental design was randomized complete block with 5 replications. Applications were made June 30. Applications were made with a CO₂ compressed air sprayer delivering 38 gal/A and the adjuvant Kinetic was included in all sprays at 0.1% v:v. Evaluations were made 6 July by counting all thrips on 10 plants in the center of each plot.

Treatment and rate/A	Thrips/10 plants ¹
Flocanimid 50WG 0.088 lb ai	96.0 a
Pyridalyl (S-1812) 35 WP 0.4 lb ai	120.2 a
Agri-Mek 16 fl oz	75.2 ab
Ultiflora 24 fl oz	110.0 a
Regent SC 4.2 fl oz	30.0 b
Proclaim 4.8 oz	100.8 a
Clutch 4 oz	89.4 ab
Actara 4 oz	85.8 ab
Warrior 3.8 fl oz	77.6 ab
SpinTor 10 fl oz	82.2 ab
Untreated Check	137.0 a

¹ Numbers not followed by the same letter are significantly different (P = 0.05) by SNK.

CONTROL OF ONION THRIPS, TRIAL TWO, FT. COLLINS, CO 2004: Trials were conducted on seeded onions at the Agriculture Research Demonstration and Education Center north of Ft. Collins, CO. Plots consisted of two double-row beds on 25-ft centers, 25-ft in length. Experimental design was randomized complete block with 5 replications. Experimental design was randomized complete block with 4 replications. Applications were made July 17. Applications were made with a CO₂ compressed air sprayer delivering 38 gal/A and the adjuvant Kinetic was included in all sprays at 0.1% v:v. Evaluations were made by counting all thrips on 10 plants in the center of each plot.

Abamectin (Agri-Mek) and fipronil (Regent) showed greatest suppression of thrips at 4 DAT. The high rate of fipronil continued to show thrips suppression at 10 DAT.

Treatment and rate	Thrips/10 leaves ¹	
	20 July	27 July
Agri-Mek 16 fl oz	50.2 b	191.5 ab
Regent SC 3.0 fl oz	57.0 b	105.8 b
Regent SC 1.0 fl oz	73.8 b	162.2 ab
Warrior 3.8 fl oz	129.2 a	208.8 a
Diatect IV 3 lbs	182.5 a	186.0 ab
Diatect II	184.0 a	203.8 a
Untreated Check	211.8 a	216.2 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

EVALUATION OF PRE-PLANT DIP OF ONION TRANSPLANTS FOR CONTROL OF ONION THRIP, FT. COLLINS, CO 2005:

Trials were conducted at the Horticulture Field Research Center in Ft. Collins, CO. Treatments consisted of dipping transplants in insecticide solutions and planting them upon drying. The onion source ('Exacta') originated from the Imperial Valley and was infested at planting with approximately 0.5 *Thrips tabaci*/plant. Pretesting of the retention of insecticide solutions allowed adjustment for a rate of insecticide based on a planting population of 53,000/A. Plants were dipped to cover the base of the emergent leaves and allowed to dry for 4 hours. They were then planted 17 April as single rows 17-ft in length, with plots arranged in a randomized complete block design with four replications. Evaluations were made by counting all thrips on 10 plants/plot. Subsequent survey of thrips species indicated populations were essentially 100% *Thrips tabaci*. Yields were taken from 10 row-ft in the center of each plot.

Treatment and rate/53,000 plants	Thrips/10 plants ¹			
	2 Jun	13 Jun	28 Jun	14 Jul
Warrior w/ Zeon				
Technology 3.84 fl oz	180.6 a	256.0 a	381.2 a	378.8 a
Success 10 fl oz	150.4 a	252.4 a	297.4 a	297.8 ab
Agri-Mek 0.15 E 16 fl oz	170.2 a	185.2 a	220.0 ab	302.2 ab
Regent 4SC 4.2 fl oz	16.4 b	8.2 b	93.8 b	124.4 b
Water Check	181.6 a	201.8 a	349.4 a	365.0 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

June 2 - df 4; F = 6.29; Pr>F = 0.0019

June 13 - df 4; F = 10.26; Pr > F = 0.00001

June 28- df 4; F = 6.42; Pr > F 0.0017

July 14 - df 4; F = 3.94; Pr > F 0.0163

Treatment	Weight (lbs)/10 row feet ¹			
	Total	Colossals	Jumbo	Mediums
Warrior	19.48 b	0.2 a	10.5 b	6.72 a
Success	26.4 a	1.26 a	16.8 a	6.56 a
Agri-Mek	28.16 a	1.44 a	9.46 a	5.64 a
Regent 4SC	28.4 a	1.68 a	18.36 a	5.4 a
Water Check	21.48 b	0.0 a	11.68 b	7.4 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

Total - df 4; F = 7.87; Pr>F 0.0006 Colossals - df 4; F = 1.42; Pr>F 0.2646

Jumbos - df 4; F = 5.51; Pr > 0.0037 Mediums - df 4; F = 0.60; Pr > 0.6647

EVALUATION OF PLANTING TIME IN-FURROW DRENCH OF ONION TRANSPLANTS FOR CONTROL OF ONION THRIPS, FT. COLLINS, CO 2005: Trials were conducted at the Horticulture Field Research Center in Ft. Collins, CO. The onion source ('Exacta') originated from the Imperial Valley and was infested at planting with approximately 0.5 *Thrips tabaci*/plant. Transplanting was done 17 April as single row beds 22-ft in length, with plots arranged in a randomized complete block design with four replications. At planting a furrow was made in which plants were placed. A solution of tested insecticides was then dribbled into the furrow using a water volume of 100 gal/A. Evaluations were made by counting all thrips on 10 plants/plot. Subsequent survey of thrips species indicated populations were essentially 100% *Thrips tabaci*. Yields were taken 17 August from 10 row-ft in the center of each plot.

Treatment and rate/A	Thrips/10 plants ¹			
	2 Jun	13 Jun	28 Jun	14 Jul
Platinum 8 fl oz	10.0 b	7.4 b	193.6 a	427.0 a
Regent 4SC 4.2 fl oz	5.6 b	2.6 b	27.2 c	41.8 c
Untreated Check	78.2 a	62.4 a	114.8 b	238.4 b

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

June 2 - df 2,4; F = 12.93; Pr>F = 0.0031 June 13 - df 2,4; F = 19.00; Pr > F = 0.0009
 June 28 - df 2,4; F = 12.55; Pr > F 0.0034 July 14 - df 2,4 F = 16.45; Pr > F 0.0015

Treatment	Yield/10 row-ft ¹			
	Total	Colossals	Jumbos	Mediums
Platinum	13.8 b	0.28 a	6.72 b	4.84 a
Regent 4SC	18.12 a	1.68 a	11.6 a	3.84 a
Untreated Check	11.6 b	0.0 a	4.76 b	5.36 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

EVALUATION OF POST-PLANT SIDEDRESS INSECTICIDE TREATMENTS OF ONION TRANSPLANTS FOR CONTROL OF ONION THRIPS, LARIMER COUNTY, CO 2005:

Trials were conducted at the Agriculture Research, Demonstration and Education Center (ARDEC) of Colorado State University. The onion source ('Exacta') originated from the Imperial Valley and was infested at planting with approximately 0.5 *Thrips tabaci*/plant. Transplanting was done 21 April as double row beds 22-ft in length, at 30-in spacing of bed centers. Plots were arranged in a completely randomized design with four replications. Applications were made May 6 by dribbling insecticides at the base of plants in a volume of 80 gal/A. A light rain followed almost immediately upon application and several rainfall events occurred in the next two weeks. Plots were subsequently in-furrow irrigated. Evaluations were made by counting all thrips on 10 plants/plot. Subsequent survey of thrips species indicated populations were essentially 100% *Thrips tabaci*. Assessment of Iris yellow spot virus (IYSV) incidence was taken at harvest and yields were assessed from 10-ft of bed in the center of plots.

Treatment and rate	Thrips/10 plants ¹			
	8 Jun	22 Jun	13 Jul	IYSV/plot (%)
Admire 20 fl oz./A	105.25 b	284.75 ab	195.0	5.25 ab
Platinum 8 fl oz/A	297.00 a	350.75 a	117.0	8.75 a
Regent 4.2 fl. oz/A	143.75 b	116.75 b	154.75	2.25 b
Untreated Check	388.75 a	348.75 a	95.75 n.s.	3.25 b

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

June 8 - df 3; F = 9.98; Pr>F 0.0014

June 22 df 3; F = 3.97; Pr>F 0.0354

July 13 df 3; F = 1.60; Pr > F 0.2403

IYSV F = 5.00; Pr > F 0.0178

Treatment and rate	Yield/10-ft of bed ¹			
	Total	Colossals	Jumbos	Mediums
Admire 20 fl oz./A	35.0 a	6.6 a	25.8 a	2.0 a
Platinum 8 fl oz/A	36.2 a	7.4 a	25.7 a	1.8 a
Regent 4.2 fl. oz/A	35.1 a	7.7 a	25.3 a	1.8 a
Untreated Check	36.9 a	12.5 a	20.5 b	2.6 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

Total Weight df 3; F = 0.37; Pr>F 0.7754

Colossals df 3; F = 3.30; Pr>F 0.0577

Jumbos df 3; F = 5.00; Pr > F 0.0177

Mediums df 3; F = 0.68; Pr > F 0.5810

EVALUATION OF POST-PLANT SIDEDRESS INSECTICIDE TREATMENTS OF SEEDED ONIONS FOR CONTROL OF ONION THRIPS, LARIMER COUNTY, CO 2005: Trials were conducted at the Agriculture Research, Demonstration and Education Center (ARDEC) of Colorado State University. Onions ('Vantage') were seeded April 6 in double-row beds at 30-in centers. Plots were established as single beds, 25-ft in length and arranged in a completely randomized design with four replications. Applications were made June 14 by making a furrow in the center of the bed and dribbling insecticides into the furrow in a volume of 80 gal/A. The furrow was immediately covered. Plots were subsequently in-furrow irrigated and there was little precipitation subsequent to evaluation. A single evaluation was made July 19, counting all thrips on 10 plants/plot. Additional evaluations were not made since there was no evidence of treatment effects.

Treatment and rate	Thrips/10 plants
Admire 20 fl oz./A	108.8
Platinum 8 fl oz/A	57.8
Regent 4.2 fl. oz/A	74.8
Belay 16WDG 16 oz/A	89.5
Untreated Check	54.8 n.s. (P = 0.05)

EVALUATION OF FOLIAR INSECTICIDES ON TRANSPLANT ONIONS FOR CONTROL OF ONION THRIPS, LARIMER COUNTY, CO 2005:

Trials were conducted at the Agriculture Research, Demonstration and Education Center (ARDEC) of Colorado State University. The onion source ('Teton') originated from south of Phoenix, AZ and was infested at planting with approximately 0.07 *Thrips tabaci*/plant. Transplanting was done 21 April as double row beds 25-ft in length, at 30-in spacing of bed centers. Plots were arranged in a completely randomized design with four replications.

Applications were made July 5 using a CO₂ compressed air sprayer, delivering 50 gal/A in a flat fan pattern directed at both sides of the bed and over the top of plants. Evaluations were made by counting all thrips on 10 plants/plot. Surveys of adults collected from untreated plants at the initiation of trials indicated an approximate ratio of 72.5/27.5 ratio of *Thrips tabaci*/*Frankliniella occidentalis* present on the onions.

Treatment and rate	Thrips/10 plants ¹	
	7 Jul	13 Jul
Warrior W/Zeon Technology 28 GA/Ha	711.8 bc	350.0
Agri-Mek 0.15EC 13.2 GA/Ha	516.0 cd	306.8
Actara 25WDG 52.5 GA/Ha	521.8 cd	268.8
Actara 25 WDG 70.0 GA/Ha	636.0 bc	340.3
Warrior 28 GA/Ha + Agri-Mek 13.2 GA/Ha	339.3 d	319.5
A13623 247SC 49.5 GA/Ha	808.5 ab	399.0
A13623 247 SC 62.0 GA/Ha	693.3 bc	311.0
Actara 25 WDG 52.5GA/Ha		
+ Agri-Mek 0.15EC 13.2 GA/Ha	481.3 cd	311.8
Actara 25 WDG 52.5GA/Ha		
+ Agri-Mek 0.15EC 27.0 GA/Ha	493.8 cd	337.0
Warrior W/Zeon 27.0 GA/Ha		
+ Agri-Mek 0.15EC 27.0 GA/Ha	270.5 d	342.3
Lannate LV 1.5 pts/A	925.5 a	285.5
Untreated Check	278.8 d	262.8 n.s.

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK.

EVALUATION OF FOLIAR INSECTICIDES ON TRANSPLANT ONIONS FOR CONTROL OF ONION THRIPS, TRIAL TWO, LARIMER COUNTY, CO 2005: Trials were conducted at the Agriculture Research, Demonstration and Education Center (ARDEC) of Colorado State University. The onion source ('Teton') originated from south of Phoenix and was infested at planting with approximately 0.07 *Thrips tabaci*/plant. Transplanting was done 21 April as double row beds 30-ft in length, at 30-in spacing of bed centers. Plots were arranged in a completely randomized design with four replications. Applications were made July 5 using a CO₂ compressed air sprayer, delivering 50 gal/A in a flat fan pattern directed at both sides of the bed and over the top of plants. Evaluations were made by counting all thrips on 10 plants/plot. Surveys of adults collected from untreated plants at the initiation of trials indicated an approximate ratio of 72.5/27.5 ratio of *Thrips tabaci*/*Frankliniella occidentalis* present on the onions.

Treatment and rate	Thrips/10 plants ¹	
	7 Jul	10 Jul
Carzol 80SP 1.0 lb/A	408.0 b	369.8 b
Carzol 80SP 1.25 lb/A	301.5 b	362.5 b
Regent 4SC 4.2 fl oz/A	295.3 b	409.8 b
Warrior W/Zeon Technology 3.84 fl oz/A	612.3 a	815.0 a
Lannate L 1.5 pts/A	270.3 b	398.8 b
Untreated Check	646.8 a	838.8 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK. 7 July - DF 5 F=14.91; Pr > F, <0.0001. 10 July - DF 5 F= 23.38; Pr > F <0.0001.

EVALUATION OF PLANT FILMS APPLIED TO SEEDED ONIONS FOR CONTROL OF ONION THRIPS, LARIMER COUNTY, CO 2005: Trials were conducted at the Agriculture Research, Demonstration and Education Center (ARDEC) of Colorado State University. Onions ('Vantage') were seeded April 6 in double-row beds at 30-in centers. Plots were established as three double row beds, 15-ft in length and arranged in a completely randomized design with four replications, at 30-in spacing of bed centers. Plots were arranged in a completely randomized design with four replications. Applications were made June 14, June 24 and July 12 as a spray in a water volume of 100 gal/A to cover plants. Evaluations were made by counting all thrips on 10 plants in the center bed of each plot.

Treatment and rate	Thrips/10 plants ¹	
	6 Jul	19 Jul
Surround-at-Home 10 lbs/A	68.0	81.5
Diatect V 2 lbs/A	80.8	77.3
Diatomaceous Earth 3 lbs/A	74.5	64.8
C-M PowderGard 10 lbs/A	67.8	70.3
Untreated Check	53.0 n.s.	84.5 n.s

¹No treatments were significant (P = 0.05) by SNK. July 6 - df 4 F = 0.56; Pr > F 0.6938. July 19 - df 4; F = 0.21; Pr > F = 0.9272.

CONTROL OF ONION THRIPS WITH FOLIAR INSECTICIDES, ROCKY FORD, CO, 2005:

Trials were conducted at the Arkansas Valley Research Center (Rocky Ford, CO) on onions ('Cometa') seeded March 11. At the origin of the trial (June 6) population consisted of mixed populations of *Thrips tabaci* (ca 54%) and *Frankliniella occidentalis* (ca 46%). A subsequent evaluation June 29 found an approximate 2:1 division of *T. tabaci* and *F. occidentalis*. Individual plots were consisted of a single double-row bed 35-ft in length. Experimental design was completely randomized with four replications. Applications were made with a CO₂ compressed air sprayer, delivering 33 gal/A, with flat fan nozzles directed along the sides of each side of the bed. The initial application was made June 6; a reapplication was made on June 26. Two treatments (Mustang, SpinTor) were dropped in this second application. Evaluations were made by counting all thrips on 10 plants in the center of each plot.

Treatment and rate/A	Thrips/10 plants ¹		
	16 Jun	29 Jun	8 Jul
Carzol 80SP 1.0 lb	39.8 b	29.8 cde	47.8 abc
Warrior w/ Zeon Technology 3.84 fl oz	23.8 b	92.0 a	49.0 abc
Oberon 2SC 12 fl oz	31.5 b	92.0 a	89.0 ab
Agri-Mek 0.15EC 8 fl oz	26.8 b	56.8 abcd	60.8 abc
SpinTor 2SC 10 fl oz	30.5 b	xx	xx
Mustang Max 4 fl oz	9.5 b	xx	xx
Assail 70W 1.7 oz	29.3 b	44.8 bcde	65.5 abc
Proclaim 5WDG 4.8 oz	36.3 b	51.5 abcde	51.8 abc
Clutch 50WDG 4.0 oz	35.0 b	64.0 abc	73.5 abc
Regent 4SC 4.0 fl. oz.	15.0 b	19.5 de	32.8 c
Actara 25WDG3.0 oz	34.5 b	78.0 ab	83.8 ab
Untreated Check	86.3 a	87.0 ab	86.8 ab

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK. xx – plots were not sampled on that date.

EVALUATION OF POST-PLANT SIDEDRESS INSECTICIDE TREATMENTS OF SEEDED ONIONS FOR CONTROL OF ONION THRIPS, ROCKY FORD, CO 2005: Trials were conducted at the Arkansas Valley Research Center of Colorado State University. Onions ('Cometa') were seeded March 11 in double-row beds at 30-in centers. Plots were established as single beds, 35-ft in length and arranged in a completely randomized design with four replications. Applications were made June 16 by making a furrow in the center of the bed and dribbling insecticides into the furrow in a volume of 50 gal/A. The furrow was immediately covered. Plots were subsequently in-furrow irrigated and there was no significant precipitation subsequent to evaluations. Thrips populations were monitored by counting all thrips on 10 plants/plot. A survey of the site on June 29 found an approximate 2:1 division of *Thrips tabaci* and *Frankliniella occidentalis*.

Treatment and rate/A	Thrips/10 plants ¹	
	29 Jun	8 Jul
Admire 14.2 fl oz./A	73.5	74.3
Platinum 5.7 fl oz/A	87.5	73.5
Regent 3 fl. oz/AI	80.5	48.5
Belay 16WDG 11.4 oz/A	67.3	69.5
Untreated Check	78.0 n.s.	80.0 n.s.

¹No treatments were significant (P = 0.05). June 29 - df 4, F= 0.92; Pr > F 0.4790. July 8 - df 4; F = 1.61; Pr > F 0.2244.

EVALUATION OF PIPERONYL BUTOXIDE WITH LAMBDA-CYHALOTHRIN FOR CONTROL OF ONION THRIPS, ROCKY FORD, CO, 2005: Trials were conducted at the Arkansas Valley Research Center (Rocky Ford, CO) on onions ('Cometa') seeded March 11. The primary trial focus was to evaluate the effectiveness of piperonyl butoxide in combination with lambda-cyhalothrin (Warrior with Zeon Technology). At the origin of the trial thrips populations consisted of *Thrips tabaci* and *Frankliniella occidentalis* in an approximate 2:1 division. Individual plots were consisted of a single double-row bed 35-ft in length. Experimental design was completely randomized with four replications. Applications were made June 26 with a CO₂ compressed air sprayer, delivering 33 gal/A, with flat fan nozzles directed along the sides of each side of the bed. Evaluations were made by counting all thrips on 10 plants in the center of each plot.

Treatment and rate/A	Thrips/10 plants ¹	
	29 Jun	8 Jul
Warrior 1.25 fl oz/A	45.5 ab	64.8
Warrior 2.5 fl oz/A	54.5 ab	67.8
Warrior 3.86 fl oz/A	42.0 ab	64.0
Piperonyl Butoxide 1.88 fl oz/A	61.5 a	85.3
Warrior 1.25 fl oz/A + PBO	43.3 ab	66.0
Warrior 2.5 fl oz/A + PBO	36.8 ab	64.0
Warrior 3.86 fl oz/A + PBO	34.8 ab	54.5
Lannate L 2 pts/A	21.3 b	55.0
Untreated Check	68.0 a	74.8 n.s.

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK. June 29 DF 8; F = 3.28; Pr > F 0.0096. July 8 DF 8; F = 0.98; Pr. > F 0.4745.

EVALUATION OF PIPERONYL BUTOXIDE WITH LAMBDA-CYHALOTHRIN FOR CONTROL OF ONION THRIPS, LARIMER COUNTY, CO 2005:

Trials were conducted at the Agriculture Research, Demonstration and Education Center (ARDEC) of Colorado State University on onions ('Vantage') seeded April 6. The primary trial focus was to evaluate the effectiveness of piperonyl butoxide in combination with lambda-cyhalothrin (Warrior with Zeon Technology). Individual plots were consisted of a single double-row bed 25-ft in length. Experimental design was completely randomized with four replications. Applications were made June 22 with a CO₂ compressed air sprayer, delivering 33 gal/A, with flat fan nozzles directed along the sides of each side of the bed. Evaluations were made by counting all thrips on 10 plants in the center of each plot. Thrips present at the site were determined to be essentially 100% *Thrips tabaci*.

Treatment and rate/A	Thrips/10 plants ¹	
	6 Jul	13 Jul
Warrior 1.25 fl oz/A	1008.8 a	324.0
Warrior 2.5 fl oz/A	1089.8 a	301.3
Warrior 3.86 fl oz/A	1049.0 a	361.3
PBO 1.88 fl oz/A (55.5 ml)	1139.5 a	259.3
Warrior 1.25 fl oz/A + PBO 1.88 fl oz/A	921.3 a	283.5
Warrior 2.5 fl oz/A + PBO 1.88 fl oz/A	943.5 a	333.0
Warrior 3.86 fl oz/A + PBO 1.88 fl oz/A	968.3 a	254.5
Lannate L 2 pts/A	668.8 b	313.5
Untreated Check	119.8 a	274.3 n.s.

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK. 6 July - DF 8; F = 5.03; Pr > F 0.0007; July 13 - DF 8; F = 0.73; Pr > F 0.6620

ONION INSECTICIDE ROTATION TRIAL, AVRC 2006: The trial was established at the Colorado State University Arkansas Valley Research Center (AVRC) at Rocky Ford, CO. Onions ('Cometa') were seeded to quadruple-row beds at 5-ft centers and individual plots consisted of a single bed 15-ft in length. Experimental design was a completely randomized design with 4 replications.

Treatments involved repeat applications of one of three insecticides (Agri-Mek, 10 fl oz/A; Lannate LV 3 pts/A, Warrior with Zeon Technology, 3.84 fl oz/A) in continuous sequence or alternated with another insecticide. Applications were made with a hand-operated compressed air sprayer delivering ca 51 gal/A. Four applications were made May 23, May 31, June 12 and June 23. Evaluations following the first application consisted of counting the number of thrips from 50 plants collected from plots treated with either Agri-Mek, Lannate, Warrior or the untreated check and washing the thrips from the plants in ethanol for species determination. Subsequent evaluations were made by counting all thrips on 10 plants in the center of each plot. In each of the latter 3 evaluations a sample of 25 plants was collected from the plots with continuous Agri-Mek, Warrior, Lannate or the untreated check plots to determine the species present.

Ratio of *Thrips tabaci*: *Frankliniella schultzei*

Treatment	30 May	13 Jun	23 Jun	7 Jul
Agri-Mek each treatment period	86:14	62:38	20:80	96:4
Lannate each treatment period	78:22	20:80	0:100	92:8
Warrior each treatment period	85:15	66:34	66:34	93:7
Untreated Check	85:15	54:46	66:34	94:3

Treatment schedule ²	Thrips/ 50 plants	Thrips/10 plants ¹	
	30 May	12 Jun	23 Jun
Agri-Mek each treatment period	180	135.3	61.0 b
AgriMek-Lannate- AgriMek - Lannate		131.0	56.8 b
AgriMek-Warrior-AgriMek-Warrior		78.5	60.3 b
Lannate each treatment period	146	111.8	42.3 b
Lannate-AgriMek-Lannate-AgriMek		111.8	41.3 b
Lannate-Warrior-Lannate-Warrior		120.8	40.3 b
Warrior each treatment period	71	117.5	51.8 b
Warrior-Lannate-Warrior-Lannate		107.5	58.5 b
Warrior-AgriMek-Warrior-AgriMek		99.3	73.8 b
Untreated Check	186	138.0	160.3 a

¹ Numbers in a column not followed by the same letter are significantly different (P = 0.05) by SNK (12 June - F = 0.68; Pr > F 0.7177; 23 June - F = 9.05, Pr > F < 0.001).

² Rate of use were Agri-Mek, 10 fl oz/A; Lannate LV 3 pts/A, Warrior with Zeon Technology, 3.84 fl oz/A). Applications were made May 23, May 31, June 12 and June 23.

ONION INSECTICIDE ROTATION TRIAL, ARDEC 2006: The trial was established at the Colorado State University Agricultural Research, Demonstration and Education Center (ARDEC) in Larimer County, CO on transplanted onions ('Rhumba'). Individual plots consisted of two double-row beds, 15-ft in length arranged in a completely randomized design with 4 replications.

Treatments involved repeat applications of one of three insecticides (Agri-Mek, 10 fl oz/A; Lannate LV 3 pts/A, Warrior with Zeon Technology, 3.84 fl oz/A) in continuous sequence or alternated with another insecticide. Applications were made with a hand-operated compressed air sprayer delivering ca 48 gal/A. Four applications were made May 29, June 8, June 15 and June 21, the latter three being made immediately following plant evaluations for thrips. Evaluations were made by counting all thrips on 10 plants in the center of each plot.

Treatment	Thrips/10 plants ¹				
	2 Jun*	8 Jun	15 Jun	21 Jun	28 Jun
Warrior each treatment period	114.3 a	172.8 a	166.5 ab	343.0 a	280.0 a
Agri-Mek each treatment period	89.5 ab	41.8 cd	93.0 b	209.8 bc	197.0 ab
Lannate each treatment period	46.0 b	19.8 d	86.3 b	95.0 c	103.0 b
Warrior-Lannate-Warrior-Lannate	107.3 a	15.3 d	124.8 ab	205.5 bc	145.8 ab
Warrior-AgriMek-Warrior-AgriMek	99.5 ab	61.5 bcd	162.3 ab	354.0 a	287.0 a
AgriMek-Lannate- AgriMek - Lannate	98.8 ab	15.5 d	124.8 ab	224.5 b	134.8 b
AgriMek-Warrior-AgriMek-Warrior	97.0 ab	111.8 b	161.0 ab	284.8 ab	192.5 ab
Lannate-AgriMek-Lannate-AgriMek	75.5 ab	37.3 d	139.0 ab	89.0 c	125.5 b
Lannate-Warrior-Lannate-Warrior	74.0 ab	79.3 bcd	187.5 a	166.8 bc	155.0 ab
Untreated Check	104.3 a	97.8 bc	118.8 ab	215.0 bc	249.3 ab

¹ Numbers within a column not followed by the same letter are significant (P = 0.05) by SNK.

June 2 F = 1.62, Pr > F 0.1556 *Log transformed F 2.37; Pr > F 0.0370

June 8 F = 11.96, Pr > F < 0.0001 June 15 F = 3.00, Pr > F 0.0114

June 21 F = 9.13, Pr > F < 0.0001 June 28 F = 4.27, Pr > F 0.0012

ONION INSECTICIDE TRIAL, AVRC 2006: Trials were established at the Arkansas Valley Research Center in Rocky Ford, Colorado on seeded onions ('Cometa') established in 4-row beds on 60-in centers. Plots were single bed, 15-ft in length and plots were arranged in completely randomized design with 4 replications. Initial treatments were applied May 31. Foliar treatments were applied in a compressed air sprayer delivering 49.8 gal/A. Straw mulch was applied at a rate of approximately 1/8 bale/plot (72.6 bales/A). Foliar treatments were reapplied June 13 after the initial evaluation. Evaluations were made by counting thrips on 10 plants in the center of a plot. The thrips species present in adjacent untreated onions were a mixture of *Thrips tabaci* and *Frankliniella schultzei* in approximate ratio of 54:46 and 66:34 on the two evaluation dates.

Treatment and rate	Adjuvant	Thrips/10 plants ¹		
		13 Jun	23 Jun	19 Jul
Warrior 3.84 fl oz		85.0	60.0 b	
Mustang Max 4 fl oz		95.3	77.3 b	
Lannate LV 1.5 pts		137.8	61.5 b	
BYI - OD 8 oz	0.1% v:v Kinetic	90.8	55.3 b	
BYI - OD 12 oz	0.1% v:v Kinetic	85.8	61.0 b	
BYI - SC 5 oz	0.25% MSO	119.2	76.8 b	
BYI - SC 5 oz	0.2% Activator	84.8	73.5 b	
BYI-SC 5 oz	0.1% Kinetic	101.8	84.3 b	
Assail 70W 1.5 oz		134.5	107.0 ab	
Mulch - straw 1/8 bale per plot		71.8	87.2 b	76.3
Success 10 fl. oz		143.3	74.3 b	
Carzol 80SP 1.0 lb		88.0	36.0 b	
Agri-Mek 10 fl oz		120.8	61.5 b	
BYI - OD 12 fl. oz		101.8	144.8 a	
Untreated Check		134.3	157.3 a	66.8

¹ Numbers in a column not followed by the same letter are significantly different (P = 0.05) by SNK (June 13 F = 1.71; Pr > F 0.0866; June 23 F = 4.30, Pr > F < 0.0001).

ONION INSECTICIDE EVALUATION TRIAL, ARDEC 2006: Trials were conducted at the Colorado State University Agricultural Research, Demonstration and Education Center in Larimer County on onions ('Yula') transplanted 21 April to double row beds. Individual plots were 15 row-ft of bed and experimental design was completely randomized with 4 replications. Treatments were initially applied 9 June with a compressed air sprayer delivering 49 gal/A; a second application made 21 June used a water volume of 58 gal/A. Evaluations were made by counting all thrips on 10 plants in the center of each plot.

Treatment and rate/A ²	Adjuvant ³	Thrips/10 plants ¹		
		12 Jun	19 Jun	26 Jul
Warrior 3.84 fl oz		77.5 ab	195.3 a	246.0 a
Lannate LV 1.5 pts		45.5 b	103.8 b	46.3 b
BYI - OD 8 oz	0.1% v:v OSS	84.3 ab	102.8 b	53.3 b
BYI - OD 12 oz	0.1% v:v OSS	67.0 ab	112.5 b	67.5 b
BYI - SC 5 oz	0.25% MSO	85.3 ab	99.8 b	48.8 b
BYI - SC 5 oz	0.2% NIS	96.8 ab	69.8 b	42.5 b
BYI- SC 5 oz	0.1% OSS	118.8 a	141.3 b	70.0 b
Carzol 1.0 lb		49.0 a	112.5 b	85.8 b
Agri-Mek 10 fl oz		57.0 ab	85.8 b	72.8 b
Untreated Check		94.3 ab	118.3 b	77.0 b

¹ Numbers in a column that are not followed by the same letter are significantly different by SNK (12 June - F 2.67, Pr > F 0.0210; 19 June - F 5.10, Pr > F 0.0003; 26 June - F = 20.31, Pr > F < 0.0001).

² Applications were made 9 June and 21 June.

³ OSS - organosilicant ; NIS – non-ionic surfactant; MSO – methyl sulfoxide

CONTROL OF ONIONS WITH PRE-PLANT TRANSPLANT DIP, ARDEC 2006: Trials were conducted on transplant onions ('Candy') established in double row beds at the Colorado State University Agricultural Research, Demonstration and Education Center in Larimer County, CO. Prior to planting transplants were separated from bundles and randomly arranged in groups for an insecticide dip. During the dip plants were submerged to cover the base of the new leaves, but the main foliage was untreated. The concentration of the insecticide dip was based on an estimate of 53,000 plants per acre, and pretrial calibration estimated that 10 bundles (500 plants) would absorb ca 1 cup of liquid.

Plants were dipped and then allowed to dry for approximately 4 hours before transplanting. Planting was done April 18 and established plots as double row beds 10-ft in length. Experimental design was completely randomized with four replications. An in-furrow application of Regent 4SC was also included, with the application made to the furrow within 5 minutes of transplanting. Plots were initially irrigated (furrow) April 21 and a significant rainfall event occurred on April 24. Evaluations were made by counting all thrips in 10 plants in the center of each plot.

Treatment and rate	Application	Thrips/10 plants ¹		
		31 May	8 Jun	26 Jun
Success 10 fl oz/A	Transplant dip	81.5 ab	130.3 a	205.8 a
Warrior 3.84 fl oz/A	Transplant dip	113.8 a	116.0 ab	164.5 a
Regent 4SC 4.2 fl oz/A	Transplant dip	15.8 b	35.0 c	112.3 a
AgriMek 0.15E 8 fl oz/A	Transplant dip	110.3 a	114.0 ab	218.0 a
Regent 4SC 4.2 fl oz/A	In-furrow	28.3 b	41.0 c	108.5 a
Untreated Check		71.3 ab	69.3 bc	182.0 a

¹ Numbers within a column that are not followed by the same letter are significantly different (P = 0.05) by SNK. May 31 - DF 5, F = 5.11, Pr > F 0.0043. June 8 - DF 5, F = 9.82, Pr > F 0.0001. June 26 - DF 5, F = 2.24, Pr > F 0.0949.

CONTROL OF ONION THRIPS ON TRANSPLANT ONIONS WITH SIDEDRESS

TREATMENTS, ARDEC 2006: Trials were conducted on transplant onions ('Candy') established 18 April in double row beds at the Colorado State University Agricultural Research, Demonstration and Education Center in Larimer County, CO. Individual plots were single beds 25-ft in length and were arranged in a completely randomized experimental design with four replications. Treatments were applied 18 May as a coarse spray in a 2-in band over the seedlings in a water volume of 92 gal/A. Evaluations were made by counting all thrips in 10 plants in the center of each plot.

Treatment and rate	Thrips/10 plants ¹		
	31 May	8 Jun	26 Jun
Regent 4.2 fl. oz/A	23.0 b	48.3 a	111.8 a
Admire 20 fl oz./A	59.8 a	37.0 a	133.8 a
Platinum 8 fl oz/A	46.5 ab	51.3 a	127.0 a
Belay 16WDG 16 oz/A	66.5 a	70.5 a	154.8 a
Untreated Check	49.5 ab	44.5 ab	94.5 a

¹ Numbers within a column not followed by the same letter are significantly different ($P < 0.05$) by SNK (31 May - DF 4, $F = 3.63$, $Pr > F 0.0293$; 8 June - DF 4 $F = 0.72$, $Pr > F 0.5896$; 26 June - DF 4; $F = 1.30$, $Pr > F 0.3156$).

EVALUATION OF ADJUVANTS TO CONTROL ONION THRIPS, GREELEY, CO 2006:

Trials were conducted in a furrow irrigated grower field of seeded onions. Individual plots were established as single, double-row beds, 25-ft in length and arranged in a completely randomized design with four replications.

Foliar treatments were applied on three dates, each one using a different onion insecticide and each application was made using 35 gal/A spray volume. The initial application was made July 2 (Carzol 80SP, 1.0 lb/A), the second application July 18 (Warrior with Zeon Technology, 3.84 fl oz/A), and the final application a week later, on July 25 (Lannate LV, 2 pts/A). All sprays were applied within two hours of preparing spray mixtures. Evaluations of all plots were made by counting thrips on 10 plants in the center of each plot.

Moderate-high thrips populations were present on the plots, ranging from 18.3-35.7 thrips/plant on the untreated check plots. However, insecticide applications provided very poor control of thrips and following the second application (Warrior, preceded by Carzol) the untreated check plants supported the lowest numbers of thrips.

Treatment ³ and rate ²	Thrips/10 plants ¹			
	12 Jul	20 Jul	24 Jul	31 Jul
Untreated Check	227.0	182.8	246.0 b	357.3 b
Insecticide alone	229.0	196.5	478.3 ab	728.3 ab
Insecticide + Interlock 2 fl oz/A + Preference 0.25% v/v	177.3	204.8	453.8 ab	538.5 ab
Insecticide + AG 06011 6 fl oz/A	136.8	200.8	501.3 ab	582.5 ab
Insecticide + AG 06037 0.5% v/v	169.5	182.3	491.8 ab	633.5 ab
Insecticide + AG 06038 0.5% v/v	148.8	202.3	471 ab	813.0 a
Insecticide + AG 06470 1% v/v + emulsifier3	185.3	206.5	564.8 a	633.8 ab
Insecticide + AG 06470 1% v/v + emulsifier3 + AG 01064 0.25% v/v	172.8	202.3	559.8 a	680.8 ab
Insecticide + Interlock 2 fl oz/A + AG 06470 1% v/v + emulsifier3	252.0	207.8	356.8 ab	655.3 ab
Insecticide + AG 06470 1.5% v/v + emulsifier3 + AG 01064 0.25% v/v	205.5	173.0	469.3 ab	528.5 ab
Insecticide + AG 06075 1 pt/100 gal	189.3	192.3	491.8 ab	520.0 ab
Insecticide + AG 01062 1 pt/100 gal	140.0	155.5	418.0 ab	689.8 ab
Insecticide + AG 06032 1 pt/100 gal	145.3	189.3	446.5 ab	618.8 ab

Table Continued...

Treatment ³ and rate ²	Thrips/10 plants ¹			
	12 Jul	20 Jul	24 Jul	31 Jul
Insecticide + AG 01061 0.5% v/v	166.3	189.8	480.0 ab	491.3 ab
Insecticide + AG 01064 0.25% v/v	245.3	199.3	568.3 a	684.5 ab
Insecticide + AG 0011 0.5% v/v	174.5 n.s.	185.3 n.s.	472.8 ab	498.3 ab

¹ Numbers within a column that *are not* followed by the same letter are significantly different ($P = 0.05$) by SNK. No significant differences detected on the first two evaluation dates. July 12 - $F=2.01$, $df 15$, $Pr > F 0.0347$; July 20 - $F= 0.71$, $df 15$, $Pr > F 0.7666$; July 24 - $F = 2.28$, $df 15$, $Pr > F 0.0159$; July 31 - $F = 2.01$, $df 15$, $Pr > F 0.0345$.

² Insecticides applied were: July 2 - Carzol 80SP, 1.0 lb/A; July 18 - Warrior with Zeon Technology, 3.84 fl oz/A; July 25 - Lannate LV, 2 pts/A.

³ Treatments included addition of pine oil emulsifier was added to AG 06470 at 1% v/v and agitated prior to mixing with the final spray solution.

EVALUATION OF CORONATINE, METHYL JASMONATE, AND ACIBENZOLAR ON CONTROL OF ONION THRIPS, ARDEC, 2006: Trials were established with transplanted onions ('Aspen') transplanted 21 April into double row beds at the Agricultural Research, Demonstration and Education Center (ARDEC) of Colorado State University in Larimer County, CO. Treatments involved application of the crop with compounds known to affect induction of various plant defense pathways used to respond to pathogens (acibenzolar, coronatine) and/or insects (methyl jasmonate). Three applications were made to the crop (June 8, June 20, July 4) and all involved a water volume of ca 30 gal/A. The only commercial product, Actigard (acibenzolar), was applied at a rate of formulation used on other registered vegetable crops. The other treatments were applied as a concentration of the spray solution - 20 nm for coronatine, 10 mM for methyl jasmonate. The coronatine preparation was diluted from a 1.6 mM stock solution diluted in methanol; no additional compounds were added to the other treatments.

Individual plots consisted of 4 beds (2.5-ft row spacing), 15-ft in length and arranged in completely randomized design with five replications. Evaluations of insects involved counting thrips present on 10 plants in the center two rows of each plot on four dates. Yields were determined by harvesting the center 5-ft from each of the two center rows on 9 August.

None of the treatments significantly affected numbers of thrips found present on plants. Visible phytotoxicity was noted on methyl jasmonate treated onions, which showed some stunting and marginal leaf burn. Significant yield reductions did occur on methyl jasmonate treated plots, primarily through reduction in larger sized jumbo class onions.

Treatment and rate	Thrips/10 plants ¹		
	19 Jun	28 Jun	13 Jul
Coronatine 20 nm concentration	115.6 a	114.8 a	6.2 a
Methyl Jasmonate 10mM concentration	154.0 a	106.8 a	4.0 a
Actigard 2 oz/A	166.0 a	119.4 a	9.4 a
Untreated Check	140.8 a	119.8 a	9.4 a

¹ Within a column numbers that are not followed by the same letter are significantly different by SNK. No significant differences were observed: June 19 - F 0.59, Pr > F 0.6307, June 28 - F 0.26, Pr > F 0.8517; 13 July - F 1.59, Pr > F 0.2315.

Treatment and rate	Yield (lbs)/10 row-ft ¹		
	Jumbo	Medium	Total
Coronatine 20 nm conc.	6.3 a	12.9 a	17.9 ab
Methyl Jasmonate 10mM conc.	1.9 a	13.0 a	13.8 b
Actigard 2 oz/A	4.4 a	14.5 a	18.9 ab
Untreated Check	7.6 a	15.3 a	22.9 a

¹ Within a column numbers that are not followed by the same letter are significantly different by SNK. Jumbo - F 2.61, Pr > F 0.0993; Medium - F = 0.72, Pr > F 0.5563; Total - F = 4.24, Pr > F 0.022.