Control of Thrips in Seed Onions and Resultant Seed Yields

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Abstract

Four insecticides were evaluated for their effect on onion seed production in Yuma County where two species on thrips (western flower and onion) were present in seed fields. Visual differences between treatments resultant from onion thrips damage was evident within 10 days after treatments were applied at flower opening. Lorsban, Ammo and Capture treatments provided control of onion thrips based on condition of seed heads. Only Ammo and Capture treatments increased seed yield as the Lorsban treatment was thought to repel bees which are needed for pollination. Pyrethroid treatments yielded 40% more than the untreated check. Damage from onion thrips to onion seed in Yuma County is conservatively calculated to currently be at least $1.1 million annually.

Introduction

Onions grown for seed is a commodity that has been viable in the Yuma area for many years, and currently is annually produced on 1,500-2,000 acres. However, in the past few years reports have been received of onion seed crops almost ruined by thrips which was threatening the onion seed industry in the Yuma area. Samples of thrips from a local onion seed field obtained by Mr. Phil Townsend, a professional crop advisor with Sunland Chemical were examined and found to have a mixture of western flower thrips, *Frankliniella occidentalis* (Pergande) and onion thrips, *Thrips tabaci* Lindeman, in roughly equal numbers of the two species (40:60 ratio). Both of these species had been previously recognized by growers and their treatment was considered critical (Howell and Waller, 1971.)

Onion thrips and western flower thrips are both reported to damage onions grown for seeds (Willcox et al., 1949). Carlson (1964), however, reported that the western flower thrips increased pollination 12-15% and does not cause injury until levels reach an average 9,000-10,000 western flower thrips per head. Bailey (1938) reported that thrips can reduce onion seed crops by as much as 50% in years of severe infestation. Research by Willcox and Shirck cited by Carlson (1964) suggested treatment in the south when 2-3 thrips were shaken out of a head, although observations noted in northen California indicated no necessity for insecticidal treatments at low population densities of flower thrips (Carlson, 1964). Differences between the various studies may have occurred because of difficulties in correctly distinguishing the two species.

The two thrips are very difficult to separate in the field, making proper decisions regarding the control measures difficult for P.C.A.s and University personnel alike. There are differences in feeding patterns and damage that will help to ascertain whether the onion thrips is present prior to head formation. While flower thrips are known to be attracted to white colors and flowers, the onion thrips does damage to the onion leaf itself. Onions thrips feeding on onions often leaves silvery injury wounds, often flecked with dark fecal spots. The western flower thrips is not known to cause this type of injury to onion. Feeding by the onion thrips is also known to result in stunted plants but cause greater damage to seed onions by feeding on onion florets resulting in destruction of the pedicels of the blossoms and the flower parts (Elmore, 1949). Onion thrips are found damaging onion plants before they head

although this species together with the western flower thrips occurs in and is thought to damage seed heads (Willcox et al., 1949).

This study was initiated to determine the effect of four insecticides on the mixed thrips populations and also determine the resultant effect upon onion seed yields which are also dependent upon bees and also influenced by thrips for pollination.

Methods and Materials

Four insecticides (Ammo 2.5 EC [cypermethrin] and Capture 2EC [bifenthrin], both FMC; Lorsban 4E [chlorpyrifos], Dow-Elanco; and Agri-Mek 0.15 EC [avermectin] Merck, Sharp and Dohme Ag-Vet + vegetable oil concentrate, Helena Co.) were applied on the evening of April 23, 1991 in a randomized complete block design along with an untreated check comparison with two replications to a field of red creole onions in the Gila Valley. Treatments were applied with a 12 row highboy sprayer. Plots were 12 rows wide by 1,045 ft long. Ammo 2.5 EC and Capture 2 EC were applied at the rate of 0.1 lbs. of active ingredient/acre, Agri-Mek 0.15 EC was applied at the 0.01 rate along with 2 qts of veg. oil conc./acre, and Lorsban 4 EC was applied at 1.0 lbs. active ingredient/acre. Bees were already present in hives around the field on the evening when treated.

Plots were sampled on April 24th, 27th, 30th, May 3rd and May 7th. Samples consisted of rapping a onion stalk against the lip of a styrofoam container 5 times and collecting the thrips contained in the onion head in the container. Two plants/plot were sampled in this manner. Sampled plants were from the center 4 rows to reduce interplot movement of thrips. Samples were returned to the laboratory, frozen, separted from chaff and pollen, and were counted. Nymphs and adults were noted but sufficient magnification was not available to make determinations to species.

Plots were harvested on July 16 and 17, 1991, with a modified John Deere 105 combine. The entire plot was harvested and seed was placed into separate bins for later cleaning and other data acquisition by personnel at H & H Seed, Yuma, AZ.

Results and Observations

Visible differences between the plots were noticeable on May 1st (8 days post treatment). These differences consisted initially of onion head color differences, although later plant height and umbel condition differences were noted. Initially, the most obvious visible differences were the browning out of the check and Agri-Mek treatments thought due to the lack of control of the onion thrips. Because Agri-Mek has a translaminar absorbtion (not systemic) and limited residual contact kill compared to synthetic pyrethroids, many tissues within the opening umbel may not have received the protection from onion thrips in/on the head compared to the other insecticide treatments. Onion thrips feeding on the stalk were probably killed by Agri-Mek although not substantiated in this study as the main objective was seed yield. Effectiveness against the western flower thirps is also expected from Agri-Mek although the extent of this is not known. The browning was associated with florets that were dessicating.

Visible color differences were still obvious later in May and early June, although height differences were also obvious at this time (color slides exist for evidence). Plots treated with Lorsban 4 EC still were whiter that the check or Agri-Mek treatments, but were somewhat less white than the Ammo or Capture treatments. Lorsban treatments were also shorter that the Ammo or Capture treated plots by 6 to 8 inches. The latter two plots were the most robust in size and color due to onion thrips control as the onion thrips has been shown to be susceptible to pyrethroids such as Ammo (Boylan-Pett et al., 1991) and certain experiments have shown that suppression of the western flower thrips on onions by pyrethroids does not occur (Sparks, 1991).

Efficacy against Thrips Overall thrips populations (Fig. 1) during the two weeks after the treatments were applied represent a mix of western flower and onion thrips. Although more thrips were expected in the untreated check compared to the other treatments this did not appear to occur. Conversely, control by any insecticide did not seem to occur based on overall thrips numbers. As western flower thrips are attracted more to white than any other color (Moffitt, 1964; Beavers et al., 1971; Yudin et al., 1987) the thrips in those plots with white seed heads (Ammo, Capture and to a lesser extent Lorsban) are thought to be primarily western flower thrips. The white color associated with these treatments is probably due to initial control of onion thrips.

Yields Differences in yields were very obvious (Fig. 2). Yields of cleaned seed per plot (1 acre in size) ranged from 1,185 lbs (Ammo) to 350 (Agri-Mek). Plots treated with either Ammo or Capture resulted in an average of some 400 lbs. clean seed per acre more than the untreated check. This was not surprising based on prior plant observations of size and head condition. This did confirm that the bees involved for pollination were apparently not adversely affected by either of the two pyrethroids used. Low yields based on plant and umbel condition were expected from Agri-Mek and the untreated check, but not from Lorsban.

The low yields associated with Lorsban may have occurred for one or more of several reasons. One possibility is that Lorsban controlled onion thrips and some western flower thrips, thereby allowing the white colored plots and reducing some additional pollination from the western flower thrips. This may be true, but the large differences noted between the pyrethroids and Lorsban plots in the amount of clean seed/acre is more likely due to bees being repelled by the Lorsban treatment in addition to the above statements.

Germination Differences in germination and seed size were almost non-existent. Percent germination ranged from 78% (Lorsban) to 94% (Lorsban, Capture). Seed size (#/lb) ranged from 127,120 (Lorsban plot with 78% germination) to 115,543 (Capture). Percent germination multiplied by lbs. clean seed/acre are shown in Fig. 3.

Economics The increased seed yield of 427.5 #/A in the Capture treatment compared to the untreated check represents a large return to the grower if this or the other pyrethroid insecticide involved in this study (Ammo) were to be registered for use on onion seed for onion thrips control. The price growers receive for clean seed of the red creole onion variety ranges from $2.00-3.50/lb., although certain other onion varieties may be worth as much as $20.00/lb. according to information from various seed company personnel. Assuming that approximately 2/3 of the 1,500-2,000 acres of onions grown in Yuma County need treatment (conservatory figure = 1,000 acres) and an increase of 400 lbs of clean seed/acre occurs utilizing a mid-price range value ($2.75), this represents an increase in seed yield or loss to thrips feeding of $1,100,000, although the actual economics could be much larger than this. Using the price received this year ($3.50/lb for clean seed) multiplied by the increased return per acre by either of the pyrethroid insecticides (approximately 425 lbs./acre for Capture and Ammo) and subtracting the cost of insecticide plus application (approximately $35.00/acre) calculates to an increased return to the grower of over $1,400 per acre.

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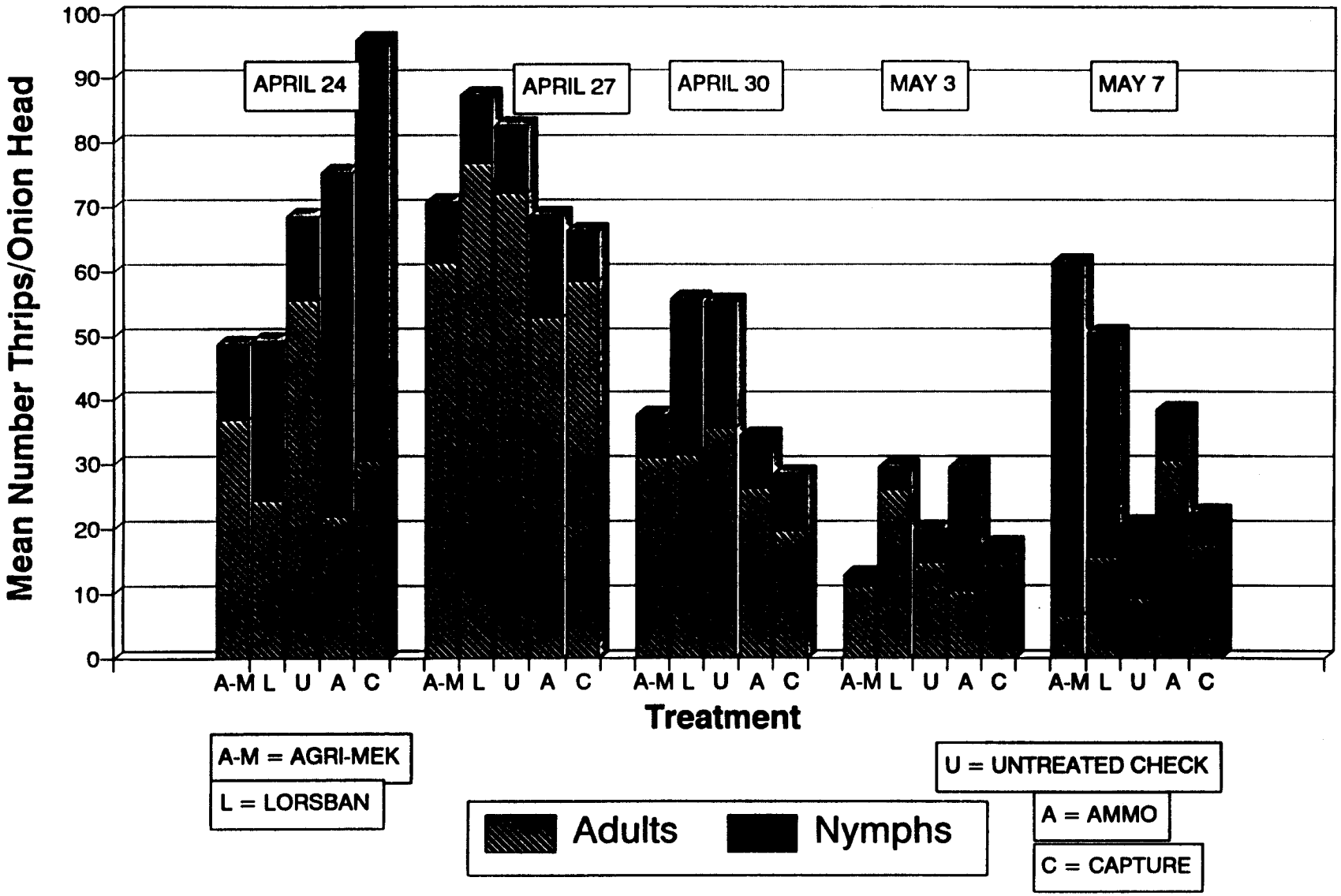
NUMBERS OF WESTERN FLOWER THRIPS AND ONION THRIPS FOLLOWING TREATMENT ON APRIL 23, 1991

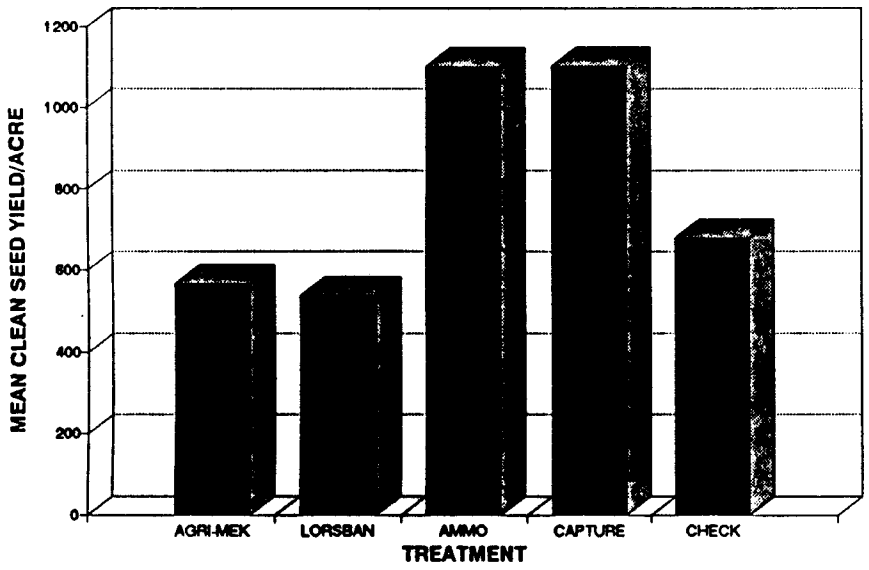
		Mean Number Thrips/Sample															
	Rate	24 Apr		27 Apr		30 Apr		3 May		7 May		Mean Yield (lb	Value/acre
Treatment	lb (AI)/acre	Ad	Nym	Ad	Nym	Ad	Nym	Ad	Nym	Ad	Nym	clean seed/acre	at $3.50/lb
Agri-Mek 0.15 EC + Vegetable Oil Concentrate	0.01 6 oz	37.0[a]	12.0[a]	61.5[a]	6.5[a]	30.75[ab]	6.75[a]	11.25[a]	1.75[a]	6.5[a]	55.0[a]	565.0[a]	$1,977.50
Ammo 2.5 EC	0.1	22.0[a]	53.5[a]	47.75[a]	9.0[a]	26.25[ab]	8.25[a]	38.5[a]	28.25[b]	30.5[b]	8.0[a]	1,100.0[a]	$3,850.00
Capture 2 EC	0.1	30.5[a]	65.5[a]	58.5[a]	8.0[a]	19.75[a]	9.0[a]	14.5[a]	3.0[a]	17.5[a]	5.0[a]	1,107.5[a]	$3,876.25
Lorsban 4E	1.0	24.5[a]	25.0[a]	76.75[a]	10.75[a]	31.5[ab]	24.5[a]	26.0[a]	3.5[a]	15.5[a]	35.0[a]	535.0[a]	$1,872.50
Untreated Check	----	55.5[a]	13.0[a]	72.25[a]	10.75[a]	35.75[b]	19.75[a]	14.75[a]	5.0[a]	9.25[a]	11.75[a]	680.0[a]	$2,380.00

Means in columns followed by the same letter are not significantly different at the $P \leq 0.05$ level (S-N-K test).

THRIPS POPULATIONS ON SEED ONIONS FOLLOWING INSECTICIDE TREATMENT ON 4-23



MEAN ONION SEED YIELD PER ACRE AFTER TREATMENTS FOR THRIPS CONTROL



ONION SEED YIELD FOLLOWING INSECTICIDE TREATMENT ON APRIL 23, 1991