A TWO-YEAR STUDY ON ALTERNATIVE METHODS FOR CONTROLLING ONION THRIPS (*THRIPS TABACI*) IN SPANISH ONIONS

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Introduction

Onions are a major economic crop in eastern Oregon and western Idaho. Annually about 20,000 acres of onions are grown in the valley. Typically the onions are Spanish hybrids and are grown for their large size, high yield, and mild flavor. The value of the Treasure Valley onion industry for the 2000 production year was 94 million dollars. Over the past 10 years the value of the industry has ranged from a high of 140 million to a low of 75 million dollars, depending upon market fluctuations.

The principal onion pest in this region is the onion thrips (*Thrips tabaci*, Lindeman). Thrips cause yield reduction by feeding on the epidermal cells of the plant, thus reducing the photosynthetic ability of the plant. Onion thrips can reduce total yields from 4 to 27 percent, depending on the onion variety, but can reduce yields of colossal sized bulbs from 28 to 73 percent. The larger sized colossal bulbs are difficult to grow and demand a premium in the marketplace. Growers typically spray three to six times per season to control onion thrips. Treatments include the use of synthetic pyrethroid, organophosphate, and carbamate insecticides. The ability of these products to control thrips has decreased from over 90 percent control in 1995 to less than 70 percent control in 2000. Onion growers are applying insecticides more frequently in order to keep thrips populations low.

Mechanical straw mulching was introduced in 1985 as a means of improving irrigation water infiltration and reducing sediment loss. Some growers using this technique reported having lower onion thrips pressure. A possible explanation for decreased thrips pressure may be from enhanced habitat for predators.

New biological insecticides that have low toxicity to beneficial predators have been developed, including neem tree extracts (azadirachtin) and bacterial fermentation products (spinosad). Both of these materials have previously been evaluated for thrips control and have performed poorly compared to the conventional insecticides. We decided to test these products in combination with straw mulch (to provide predator habitat) as an alternative program to the conventional insecticide program currently used by growers.

Materials and Methods

A 1.8-acre field was planted to onions (cv.'Vaquero', Sunseeds, Brooks, OR) on March 23, 2001 and a 2.0-acre field was similarly planted on March 12, 2002. The onions were planted as two double rows on a 44-inch bed. The double rows were spaced 2 inches apart. The seeding rate was 154,000 seeds per acre. Lorsban 15 G was applied in a 6-inch band over each row at planting at a rate of 3.7oz/1,000 ft of row for onion maggot control. Water was applied by furrow irrigation. The field was divided into plots 40.3 ft wide by 100 ft long in 2001 and 36.7 ft wide by 100 ft long in 2002. There were three treatments with six replications in 2001 and four treatments with six replications in 2002.

The three treatments were a grower-standard treatment, an untreated check, and the alternative treatment. The grower standard practice included Warrior (lambda-cyhalothrin) and Lannate (methomyl). The check did not receive any treatments for thrips control. The alternative treatment included straw mulch applied to the center of the bed plus Success (spinosad), and Ecozin or Aza Direct (azadirachtin neem extract) and Messenger (harpin protein). In 2002 an additional straw mulch-only treatment was added. Messenger was not applied in 2002.

Insecticide treatments were applied weekly or biweekly during the first half of the growing season (Table 1). All insecticides were applied in water at 29.7 gal/acre in 2001 and 32.0 gal/acre in 2002. Straw was applied only between the irrigation furrows on top of the beds to avoid confounding irrigation effects with thrips effects. The straw was applied on May 23, 2001 at a rate of 952 lb/acre and on May 28, 2002 at a rate of 1,080 lb/acre.

Thrips populations were sampled by two methods. The first was by visually counting the number of thrips on five plants in 2001 and 15 plants in 2002. The second method was by cutting five plants in 2001 and 10 plants in 2002 at ground level and inserting the plants into a modified Berlese funnel designed to hold the plants. Turpentine was used to dislodge the thrips from the plant, where they would then fall into a jar containing 90 percent isopropyl alcohol. The collected thrips were then counted through a binocular microscope. Thrips populations were monitored weekly though the growing season.

The predator populations were monitored using pitfall traps that contained ethylene glycol. They were evaluated three times per week in 2001 and one time per week in 2002. The modified Berlese funnel was also used to monitor predators foraging on the plants.

The onions were harvested on September 13 and graded on September 14 and 17 in 2001 and harvested on September 11 and graded on September 12 in 2002 (Table 5).

Results and Discussion

The onions in the conventional treatment and the alternative control treatments looked similar throughout the growing season, with minimal thrips damage to the foliage. In contrast, the onions in the untreated check treatment and the straw-only treatment (2002) had severe foliage damage due to thrips feeding. The thrips populations as determined by the modified Berlese funnel are shown in Figure 1.

The visual plant counts are shown in Figure 2. The visual counts did not correlate well with the funnel counts in 2001 but did somewhat better in 2002, where more plants were counted. Thrips populations, whether by the visual plant counts or the Berlese funnel counts, did not correlate well with visual thrips damage or with overall size and yield response, particularly in 2002. There were statistical differences in thrips populations between treatments on some of the sample dates, as shown in Tables 2 and 3.

Predator composition varied throughout the season but consisted mostly of spiders, big-eyed bugs, damsel bugs, and minute pirate bugs, with smaller populations of lacewings, ladybugs, assassin bugs, and rove beetles (Fig. 3). Spiders were initially more prevalent, followed by big-eyed bugs. Late in the season minute pirate bugs were the dominant predator. Predator counts with the Berlese funnel were not made in August of 2002, so the minute pirate bugs that are so prevalent at that time of year did not show in the 2002 data.

The highest populations of predators were in the alternative control plots in 2001, but were highest in the untreated check and straw-only plots in 2002. The alternative control plots had significantly higher predator populations than the standard treatments both years. Predator populations increased in the unsprayed and conventionally sprayed plots in August, but decreased slightly in the alternative control plots, although the population was still well above that of the conventionally sprayed plots.

In 2001 there was a significant increase in super colossal-size bulbs in the alternative treatment compared to the untreated check. There was also a significant difference between the treatments and the untreated check in total yield. There was a trend towards higher super colossals and total yield in the alternative control treatment compared to the standard control, but this was not statistically significant. In 2002 there was a statistical increase in super colossals, colossals, and total yield with the alternative treatment over any of the other treatments. The standard treatment had significantly higher yield of super colossals, colossals and total yield compared to the untreated check and the straw-only treatment. The alternative and standard treatments had significantly reduced yield of jumbo onions compared to the untreated check and straw-only treatments, as the yield shifted to the larger sized colossals and super colossals.

The alternative treatments in this trial worked better than standard grower practices. The test was not designed to determine the individual effects of spinosad or azadirachtin on yield and quality, but only to answer the question of whether these materials in combination with straw mulch might give thrips control, onion yield, and quality similar to the conventional spray program. Thrips control with the alternative program was not as good as the conventional program in 2001 but better than the conventional program in 2002. Yield and quality were excellent and were improved with the alternative treatments. The next challenges will be to determine what each alternative product is contributing towards thrips control, onion yield, and quality.

Table 1. Application data for the alternative methods for controlling onion thrips trial. Malheur Experiment Station, Oregon State University, Ontario, OR, 2001 and 2002.

2001

Standard Insecticide treatments*				Alternative Insecticide treatments			
Date Applied	Product	Formulation†	Rate/acre	Date Applied	Product	Formulation	Rate/acre
6/6	Warrior	1.0 lb/gal E.C.	4.0 oz	5/21	Messenger	Harpin protein 3%	2.8 oz
	MSR	2.0 lb/gal E.C.	1.0 qt	5/24	Messenger	Harpin protein 3%	3.5 oz
6/14	Warrior	1.0 lb/gal E.C.	4.0 oz	6/6	Success	2.0 lb/gal a.i.	10 oz
	Lorsban	4.0 lb/gal E.C.	1.0 qt	6/13	Success	2.0 lb/gal a.i.	10 oz
6/30	Warrior	1.0 lb/gal E.C.	4.0 oz		Messenger	Harpin protein 3%	4.5 oz
7/9	Warrior	1.0 lb/gal E.C.	4.0 oz	6/21	Ecozin	3% E.C.	10 oz
	Lannate LV	2.4 lb/gal WSP	3.0 pt		Success	2.0 lb/gal a.i.	10 oz
7/16	Warrior	1.0 lb/gal E.C.	4.0 oz	6/29	Ecozin	3% E.C.	10 oz
	Lannate LV	2.4 lb/gal WSP	3.0 pt		Success	2.0 lb/gal a.i.	10 oz
					Messenger	Harpin protein 3%	4.5 oz
				7/9	Ecozin	3% E.C.	10 oz
					Success	2.0 lb/gal a.i.	10 oz
					Messenger	Harpin protein 3%	4.5 oz
				7/16	Ecozin	3% E.C.	10 oz
					Success	2.0 lb/gal a.i.	10 oz
				7/31	Success	2.0 lb/gal a.i.	10 oz
					Aza Direct	1.2% E.C.	10 oz

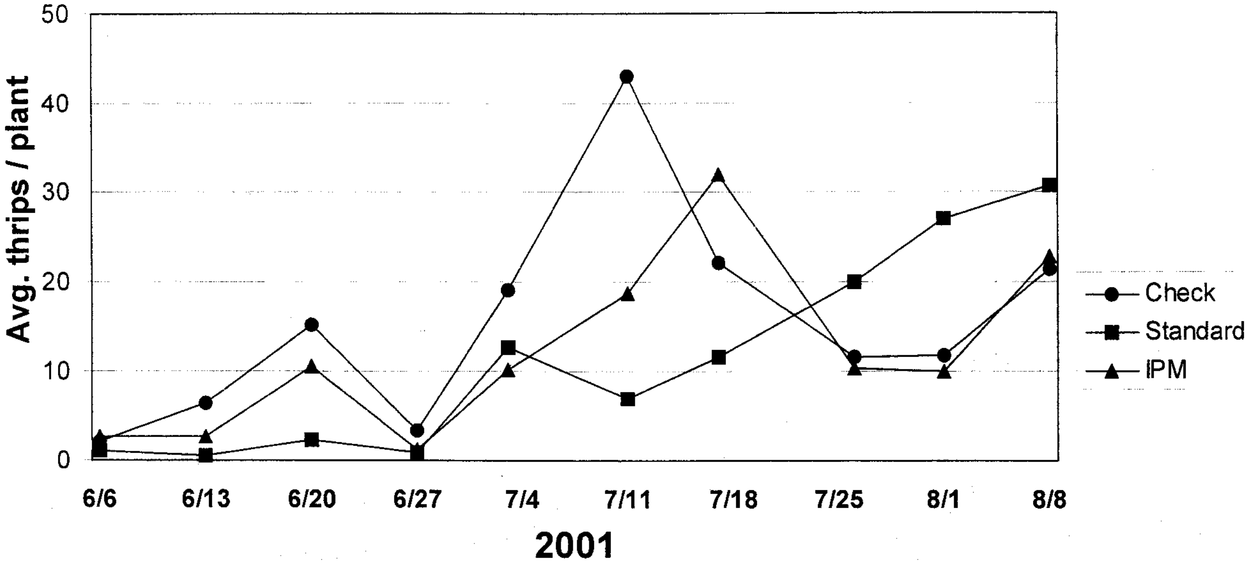
2002

Standard Insecticide treatments				Alternative Insecticide treatments			
Date(s) Applied	Product	Formulation	Rate/acre	Date(s) Applied	Product	Formulation	Rate/acre
5/30	Warrior T	1.0 lb a.i./gal	3.84 oz	5/30,6/12,			
6/12	Warrior T	1.0 lb a.i./gal	3.84 oz	6/20, 6/27,			
6/20	Warrior T +	1.0 lb a.i./gal	3.84 oz	7/2, 7/11,	Aza Direct	0.0987 lb a.i./gal	20 oz
	Lannate‡	2.4 lb a.i./gal	3.0 pt	7/24	Success	2.0 lb a.i./gal	10 oz
7/2	Warrior T +	1.0 lb a.i./gal	3.84 oz				
	Methyl Parathion‡	5.0 lb a.i./gal	21.2 oz				
7/11	Warrior T +	1.0 lb a.i./gal	3.84 oz				
	Lannate‡	2.4 lb a.i./gal	2.0 qt				
7/23	Mustang +	1.5 lb a.i./gal	4.3 oz				
	Lannate‡	2.4 lb a.i./gal	2.0 pt				

*All treatments were applied with a silicone adjuvant (Breakthrough) at 0.25% V/V.

†E.C.: emulsifable concentrate, WSP: water-soluble powder.

‡Buffered to a pH of 4.0.



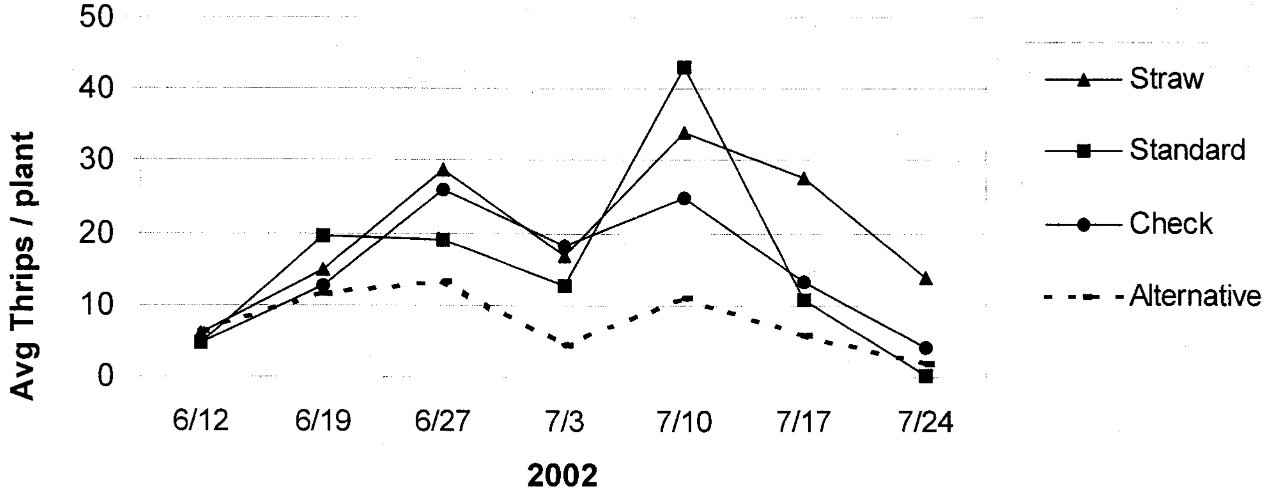


Figure 1. Thrips populations during the growing season from modified berlese funnel traps, Malheur Experiment Station, Ontario, OR, 2001 and 2002.

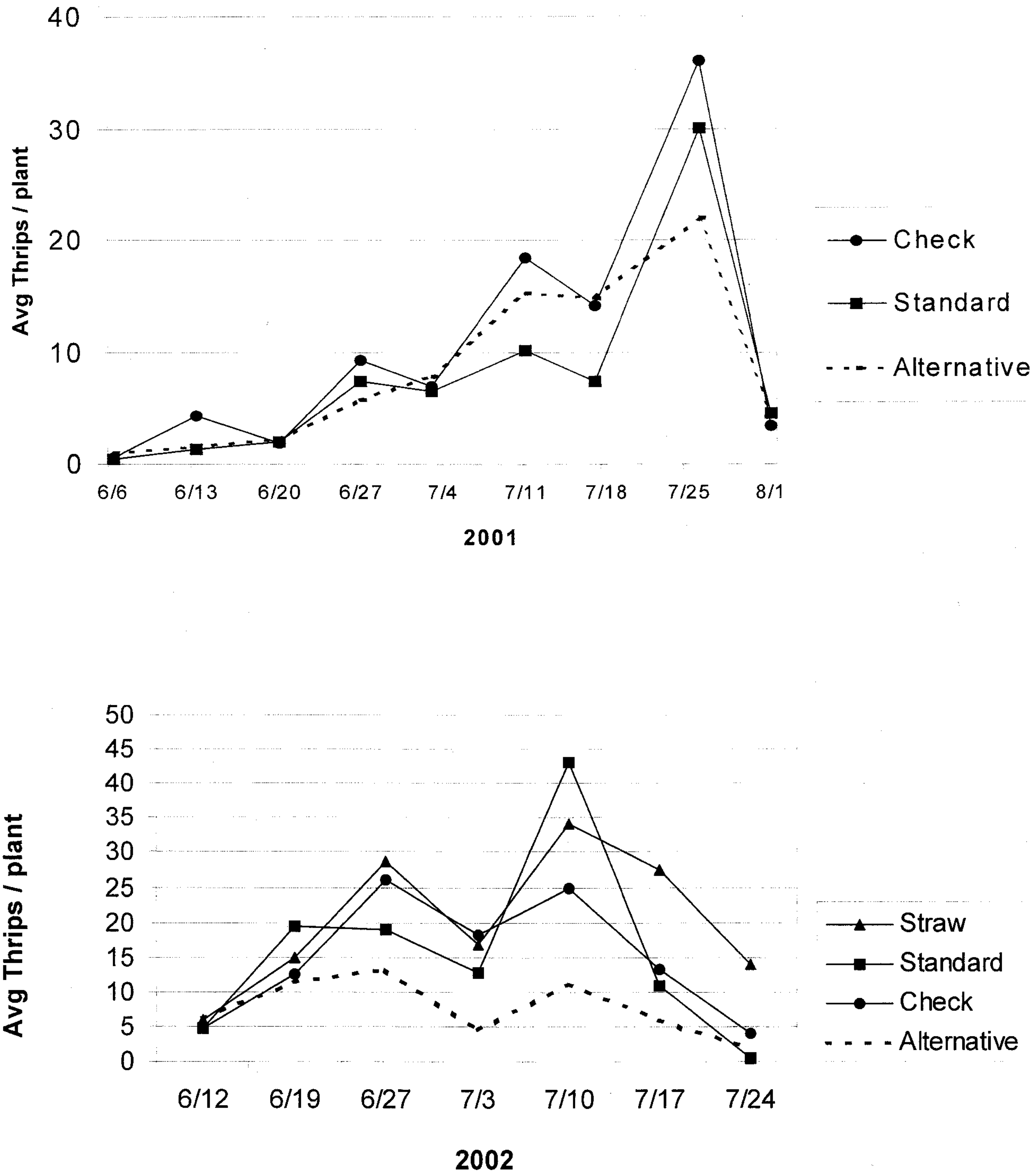


Figure 2. Thrips populations during the growing season from visual plant counts, Malheur Experiment Station, Ontario, OR, 2001 and 2002.

Table 2. Weekly thrips population as counted visually, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001 and 2002.

2001 – Average of total thrips on 5 plants

Date:	6/06	6/13	6/20	6/27	7/03	7/11	7/17	7/26	8/01
Check	0.5	4.3	1.9	9.3	7.0	18.5	14.1	36.0	3.4
Standard	0.4	1.3	2.0	7.4	6.5	10.2	7.4	30.1	4.5
Alternative	1.0	1.5	2.2	5.7	7.8	15.3	14.8	21.6	4.3
LSD (0.05)	NS	NS	NS	NS	NS	6.2	5.9	NS	NS

2002 – Average of total thrips on 15 plants

Date:	6/05	6/12	6/18	6/27	7/02	7/10	7/29
Straw	14.8	18.4	19.2	19.3	28.4	26.3	9.1
Check	15.1	17.4	18.9	24.8	31.6	22.6	10.0
Standard	13.7	19.3	28.8	34.0	38.9	31.3	11.9
Alternative	12.8	11.5	14.8	29.5	19.4	24.1	7.7
LSD (0.05)	NS	5.0	8.4	7.7	12.0	5.2	NS

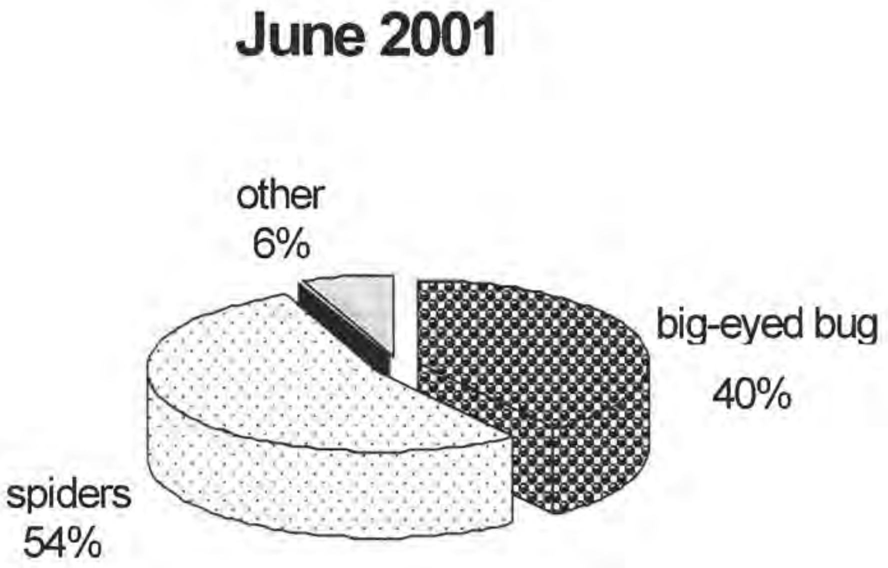
Table 3. Weekly thrips population from Berlese funnel counts, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001 and 2002.

2001 – Average of total thrips on 5 plants

Date:	6/06	6/13	6/20	6/27	7/03	7/11	7/17	7/26	8/01	8/08
Check	2.1	6.4	15.2	3.3	19.1	43	22.1	11.5	11.7	21.3
Standard	1.0	0.6	2.4	0.9	12.7	6.7	11.5	19.9	27.0	30.7
Alternative	2.7	2.6	10.5	1.3	10.2	18.6	32.0	10.4	10.0	22.7
LSD (0.05)	NS	4.1	NS	1.5	NS	18.8	NS	NS	12.0	NS

2002 – Average of total thrips on 10 plants

Date:	6/12	6/19	6/27	7/03	7/10	7/17	7/24
Straw	6.0	15.0	28.7	16.8	34.1	27.6	13.9
Check	4.8	12.7	26.1	18.4	24.8	13.2	4.1
Standard	4.8	19.5	19.1	12.7	43.1	10.9	0.4
Alternative	6.3	11.5	13.2	4.4	11.0	5.8	1.9
LSD (0.05)	NS	NS	NS	9.6	22.7	7.9	NS



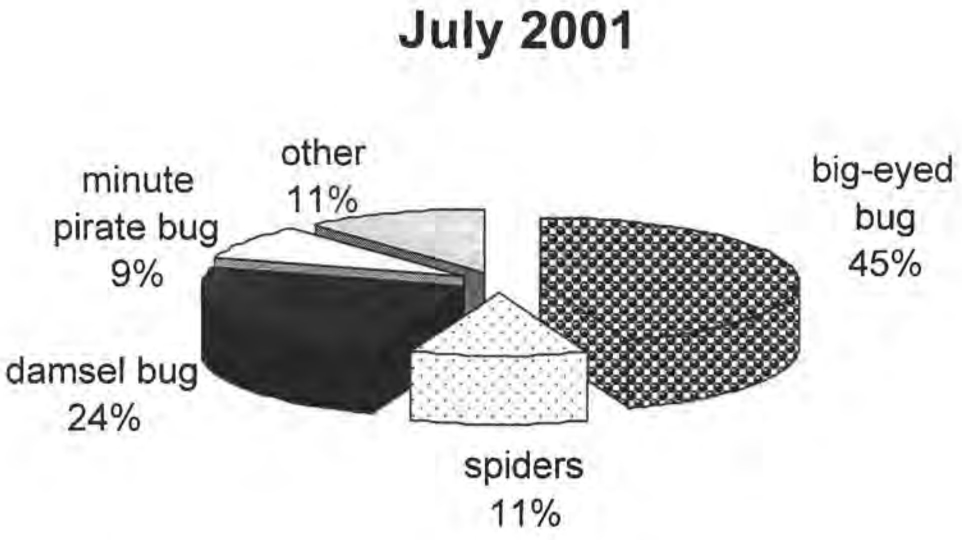
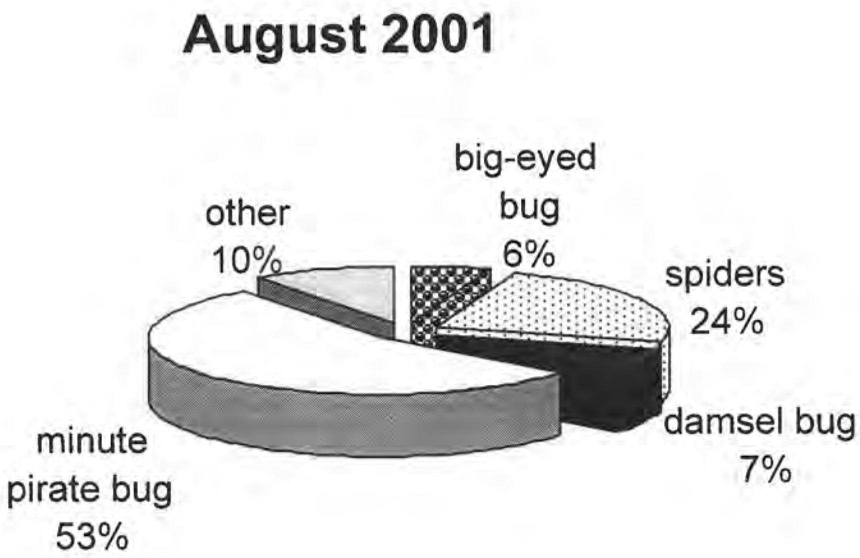
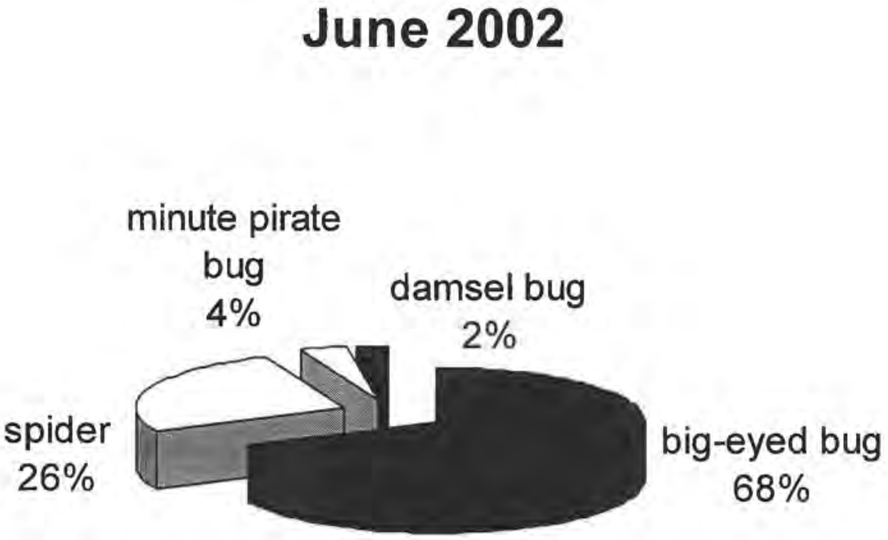


Figure 3. Predator makeup by month, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001 and 2002.





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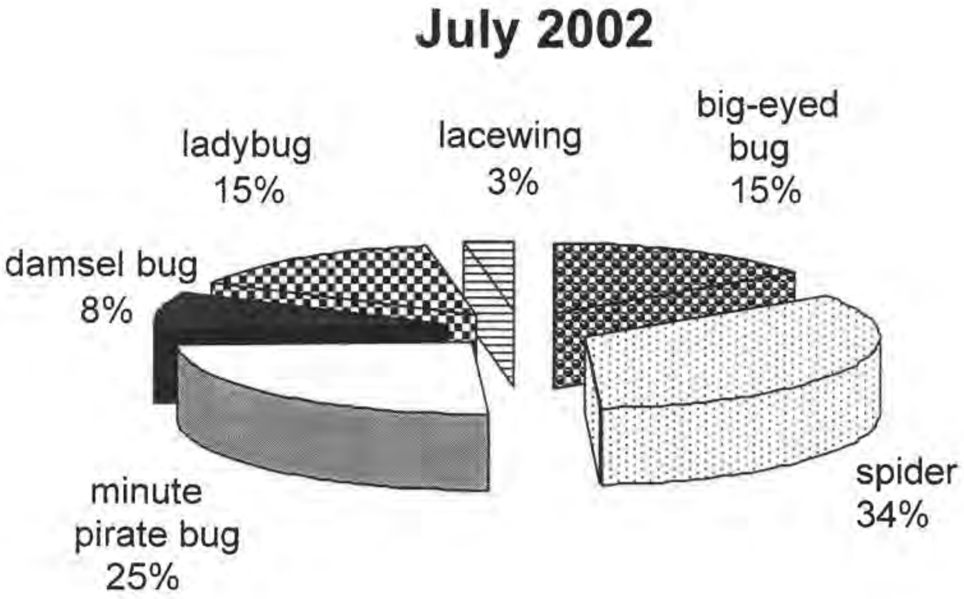


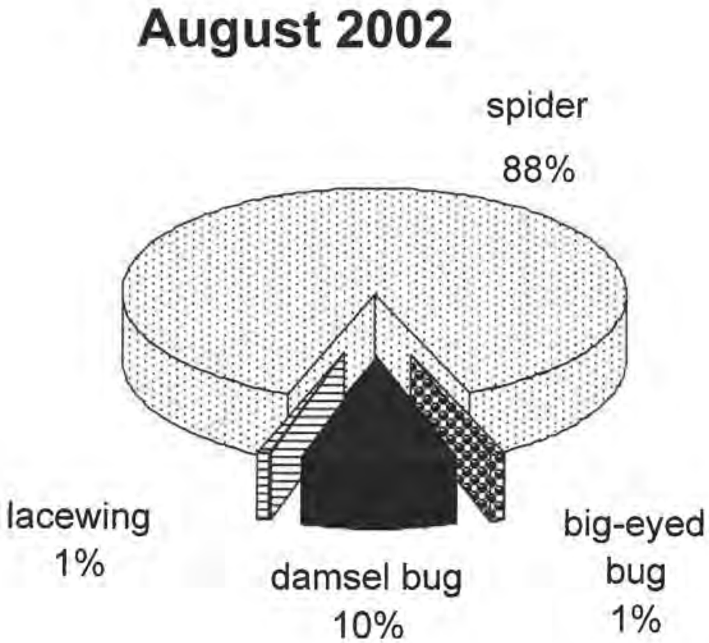
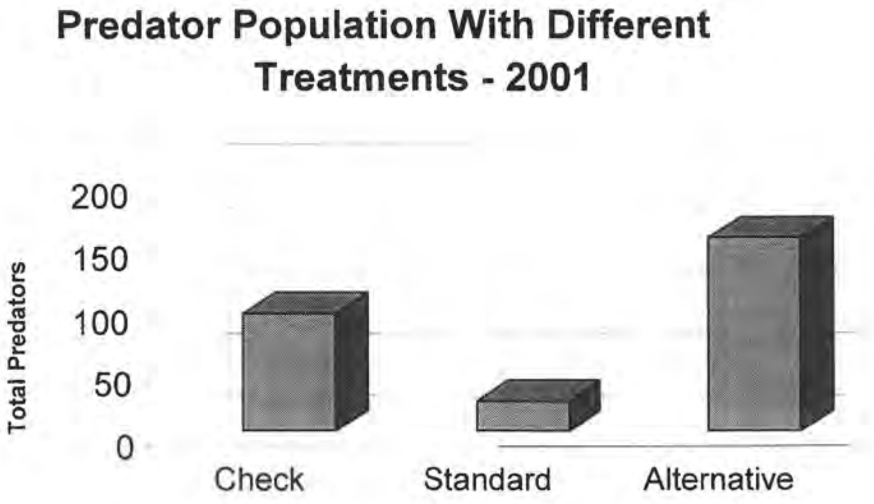


Figure 3 continued.

Table 4. Comparison of predator population by month and by treatment as measured by pitfall traps and Berlese funnel, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001.

	June	July	August	Total
Check	26	25	43	94
Standard	5	6	13	24
Alternative	64	57	33	154
LSD (0.05)	NS	NS	6.2	44.5



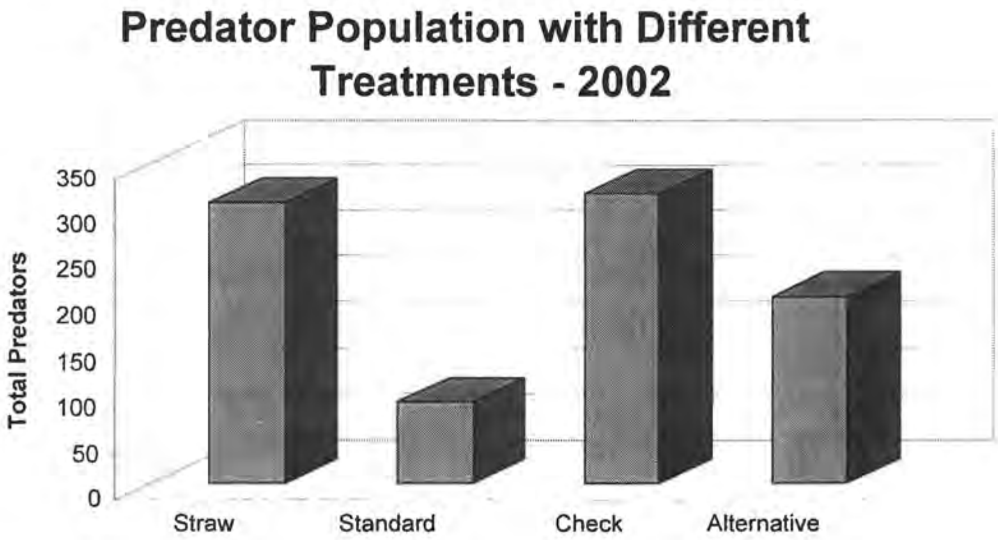


Figure 4. Treatment effect on predator populations, Malheur Experiment station, Oregon State University, Ontario, OR, 2001 and 2002.

Table 5. Onion grade and yield as influenced by commercial and alternative insecticide controls, Malheur Experiment Station, Oregon State University, Ontario, OR. 2001 and 2002.

2001

Treatment	Super colossal >4 ¼ "	Colossal 4-4 ¼ "	Jumbo 3-4"	Medium 2¼-3"	Total marketable yield	Number 2
	cwt/acre					
Untreated check	32.1	193.1	612.7	49.4	887.3	23.5
Standard	46.9	254.5	628.8	36.4	966.6	27.2
Alternative Control	63.7	305.1	609.6	30.2	1008.6	24.5
LSD (0.05)	23.8	NS	NS	NS	64.0	NS

2002

Treatment	Super colossal >4¼"	Colossal 4-4 ¼"	Jumbo 3-4"	Medium 2¼-3"	Total marketable yield
	cwt/acre				
Untreated check	9.5	153.5	724.1	35.8	922.9
Standard	47.2	327.5	668.6	23.9	1067.2
Alternative Control	65.5	408.9	631.7	23.4	1129.3
Straw	7.7	133.2	737.1	35.7	913.5
LSD (0.05)	12.5	56.8	48.8	NS	59.2