INSECTICIDE APPLICATION TIMING FOR THRIPS MANAGEMENT IN RED AND YELLOW ONIONS

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Objective

Compare the effectiveness of early-season, late-season, and full-season insecticide applications for thrips management in red and yellow onions.

Materials and Methods

To address the objective, a field trial was conducted during 2021 at Malheur Experiment Station to evaluate 1) four insecticide application programs; and 2) two onion colors. The insecticide application programs included: i) early season applications; ii) late season applications; iii) full season applications; and iv) an untreated control. The onion varieties used were i) red onions (Seminis 'SV4643NT') and ii) yellow onions (Nunhem's 'Vaquero'). The spray applications were initiated on June 1, 2021. The early season treatment had four spray applications (weeks 1 to 4); the late season treatment had four applications (weeks 5 to 8); the full season treatment had eight spray applications (weeks 1 to 8), and control had no insecticide applications. The experiment was designed as a randomized complete block design with a 4×2 factorial arrangement replicated in four blocks with eight treatments.

The trial was planted on March 24, 2021 at 150,000 seeds per acre. Seed was planted in double rows spaced 3 inches apart on beds spaced 22 inches apart. The field had drip tape laid at 4-inch depth between pairs of beds during planting. The drip tape had emitters spaced 8 inches apart and an emitter flow rate of 0.09 gal per hour (0.22 gal/min/100 ft, Toro Aqua-Traxx, Toro Co., El Cajon, CA). The distance between the tape and the center of each double row of onions was 10 inches. Standard management practices were followed to maintain the crop during the season. Onion emergence started on April 12. On May 13, alleys 4 ft wide were cut between plots, leaving plots 23 ft long.

Insecticide Applications

Insecticides were applied weekly beginning June 1 and ending by July 20, 2021. The early season treatment received four spray applications from June 1 to June 22. 2021; late season treatment received four sprays from June 29 to July 20, 2021. The full season treatment received eight applications from June 1 to July 20, 2021. The applications were made with a CO_2 backpack sprayer delivering 35 gallons per acre at 30 PSI. The sprayer has a 4-boom nozzle fitted with Tee Jet 11004 flat fan nozzles. All insecticides were applied with Dyne-amic (Helena), which is a refined MSO blend + organosilicon-based adjuvant that increases penetration of insecticides into plant tissue. Specific insecticide treatments and their application dates are given in Table 1.

Data Collection

Thrips counts were made twice per week starting May 27, which was before insecticide applications began and were used to determine when thrips populations reached a threshold of 1 per leaf to begin insecticide applications. Thereafter, counts were made two and six days after each insecticide treatment. Thrips counts were made by counting the number of thrips on 10 consecutive plants in one of the middle two double rows of each plot. Adult and larval thrips were recorded separately. In addition to individual sample date counts, total accumulated thrips numbers were determined by calculating the area under the curve for cumulative thrips numbers from one sample point to another.

To determine yield, onions from the middle two double rows in each plot were topped by hand, bagged, and moved into storage and graded. During grading, bulbs were separated according to external quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), bulbs infected with the fungus *Botrytis allii* in the neck or side, bulbs infected with the fungus *Fusarium oxysporum* (plate rot), bulbs infected with the fungus *Aspergillus niger* (black mold), and bulbs infected with unidentified bacteria in the external scales. The No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and super colossal (>4¼ inches). Bulb counts per 50 lb of super colossal onions were determined for each plot of every variety by weighing and counting all super colossal bulbs during grading. Marketable yield consisted of No.1 bulbs larger than 2¼ inches.

The effects the insecticide treatment programs, onion type (color) and their interaction on thrips numbers and onion yield were analyzed using Proc Glimmix (SAS v.9.4).

Results and Discussion

Thrips numbers exceeded the threshold number (1 thrips per leaf) on May 31; therefore, insecticide applications for the early season and full season programs began on June 1. The late season applications began on June 29.

Overall, the red onions had significantly more thrips than the yellow onions (Figures 1-3). Thrips numbers were relatively low through the middle of June but then escalated sharply, especially in the red onions in late June. There was an unusually low number of thrips in all treatments on the July 8 sample date (Figure 1). Although we have no certain explanation for this event, the sample date was at the end of a ten-day period where temperatures exceeded 100ºF. Excessive heat can slow thrips survivorship and population growth. The record heat in June and July may have also contributed to the relatively low numbers of thrips in the trial.

The three insecticide treatment programs reduced thrips numbers compared with the untreated controls (Figures 1-3). The full season treatment program had significantly lower numbers of thrips than the early season or the late season treatment programs. The late season treatment program accumulated significantly more thrips over the entire season than the early season treatment program (Figure 2). However, over the four weeks where insecticides were applied in the late season program, thrips control was as good as in the full season program (Figure 3).

Marketable yields were greater for the late season and full season insecticide programs compared with the untreated control and early season insecticide program (Table 2; Figure 4). Size profiles were shifted to larger sizes for the late season and full season insecticide programs. The

percentage of marketable onions was greater for the full season and late season insecticide programs than for the untreated control and early season insecticide programs (Table 2). This difference was especially pronounced for red onions. For the red onions, the full season and late season programs had over 20% more marketable bulbs than the untreated and early season insecticide program.

Conclusions

Red onions support greater populations of thrips than do yellow onions.

Red onions are more susceptible to thrips injury than are yellow onions.

Red onions suffer greater yield losses from thrips damage than do yellow onions.

The full season insecticide program consisting of eight weekly applications provided the best thrips control.

The early season insecticide program consisting of four weekly applications made from June 1 to June 22 did not provide adequate protection when thrips populations were at their greatest abundance in late June and July.

Although the late season program had significantly more thrips over the entire season, there were significantly fewer thrips later in the season with the insecticide applications than in the early season program.

The full season and late season insecticide programs greatly improved yield and quality compared with the untreated control and early season insecticide program.

It is important not to stop insecticide applications too early in order to maximize yields.

Acknowledgments

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Table 1. Sequence of insecticides used in the early season, late season and full season treatment programs. No insecticides were applied to the untreated control. Insecticide product names and rates per acre are given. Insecticides were applied with Dyne-amic at 11.2 fl oz per acre (0.25% vol:vol).

	Insecticide Application Program			
Date	Early Season	Late Season	Full Season	Untreated Control
1. June 01	Movento HL 2.5 fl oz Azadirachtin 16 fl oz	None	Movento HL 2.5 fl oz Azadirachtin 16 fl oz	None
2. June 08	Movento HL 2.5 fl oz Azadirachtin 16 fl oz	None	Movento HL 2.5 fl oz Azadirachtin 16 fl oz	None
3. June 15	Agrimek SC 3.5 fl oz	None	Agrimek SC 3.5 fl oz	None
4. June 22	Agrimek SC 3.5 fl oz	None	Agrimek SC 3.5 fl oz	None
5. June 29	None	Movento HL 2.5 fl oz Azadirachtin 16 fl oz	Exirel 13.5 fl oz	None
6. July 06	None	Movento HL 2.5 fl oz Azadirachtin 16 fl oz	Exirel 13.5 fl oz	None
7. July 13	None	Radiant SC 8 fl oz	Radiant SC 8 fl oz	None
8. July 20	None	Radiant SC 8 fl oz	Radiant SC 8 fl oz	None

Table 2. Yields in cwt/acre for the different insecticide application programs for yellow and red onions. Percent marketable is the percentage of weight in the medium, jumbo, colossal and supercolossal size classes relative to the total weight harvested.

			cwt/acre				
Insecticide Application Program	*Medium*	*Jumbo*	*Colossal*	*Super*	*Marketable*	*Marketable (%)*	*Marketable Yield Increase over Control (%)*
			Yellow				
Control	73.09	763.39	14.77	0.00	850.65	96.10%	
Early	58.66	801.14	68.75	1.83	929.55	97.27%	9.28%
Late	43.36	881.02	91.35	0.00	1014.8	97.46%	19.30%
Season	55.73	879.42	146.41	6.74	1087.30	98.16%	27.82%
			Red				
Control	179.62	101.13	0.00	0.00	280.50	61.15%	
Early	194.96	117.38	0.00	0.00	312.06	63.92%	11.25%
Late	175.72	184.42	0.90	0.00	360.72	72.84%	28.60%
Season	182.92	231.48	0.00	0.00	414.03	77.79%	47.60%

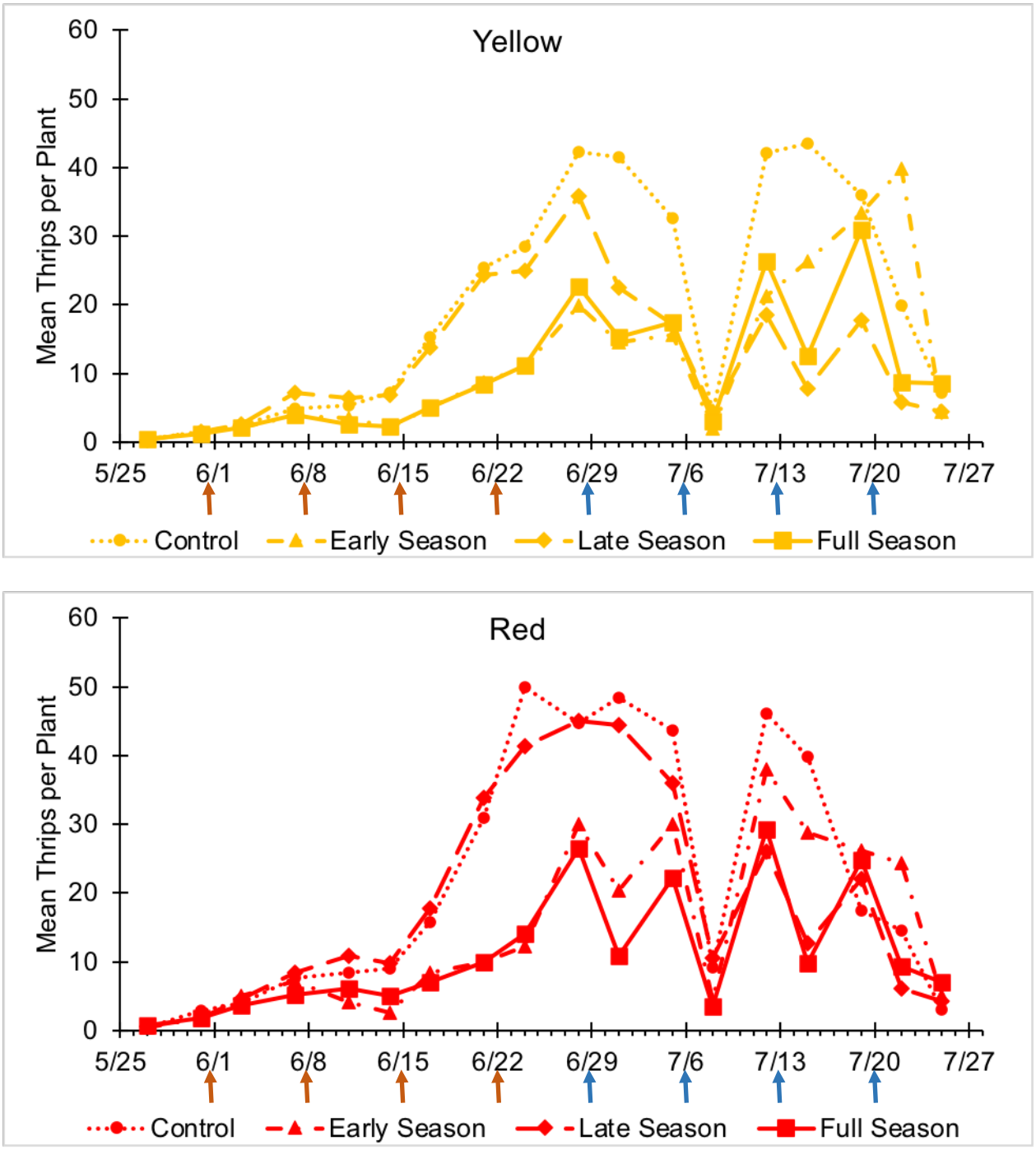

Figure 1. Mean total thrips per plant for insecticide application programs for yellow (top graph) and red (bottom graph) onions. Insecticide application dates are marked by arrows on the x-axis. Orange arrows indicate early season insecticide applications, and blue arrows indicate late season insecticide applications. Malheur Experiment Station, 2021.

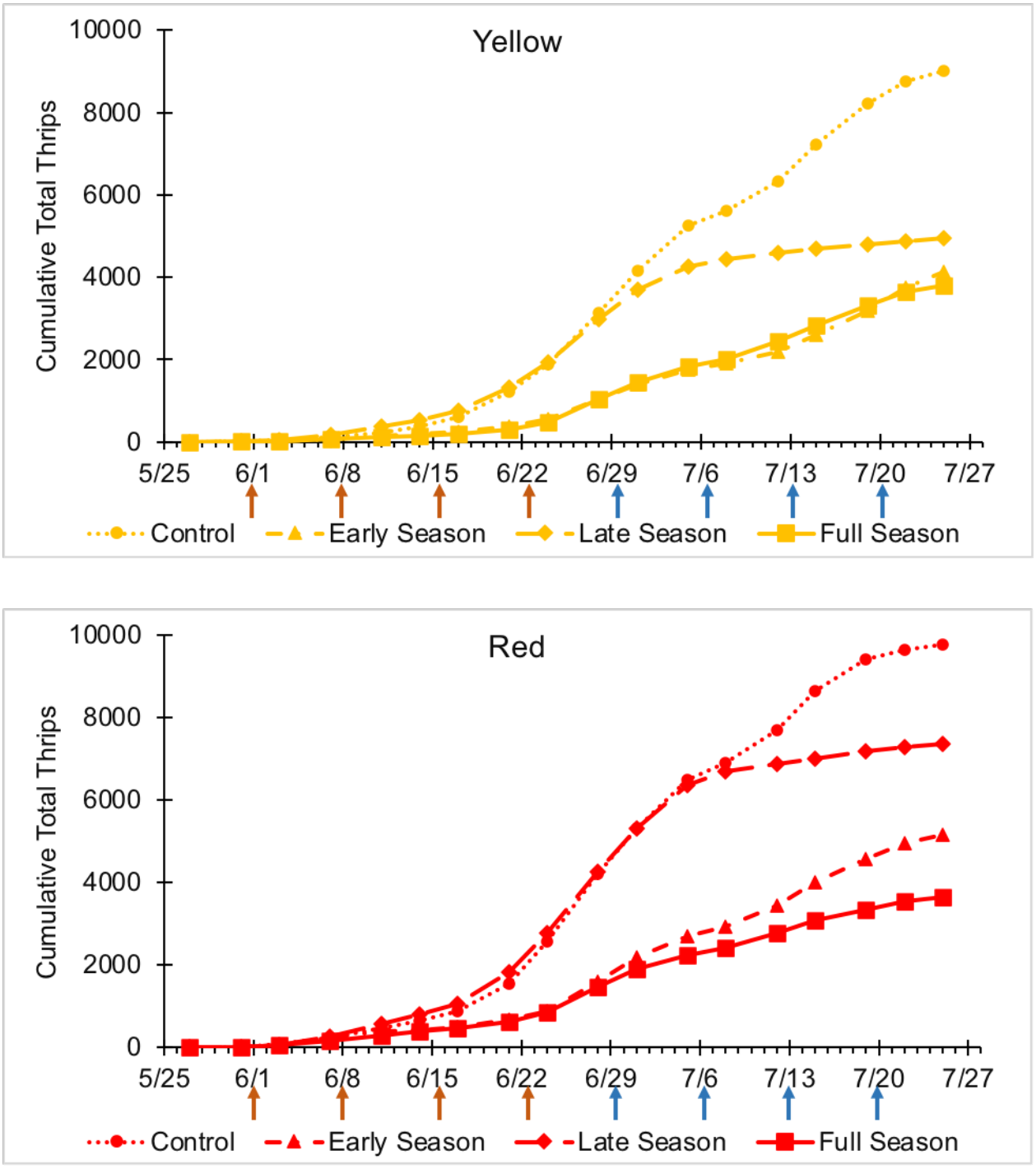

Figure 2. Cumulative thrips from May 27 to July 25 for the different insecticide application programs and onion colors. Data represent the number of thrips accumulated from one sample date to the next. The steeper the slope of the line, the greater the thrips intensity. Data for the yellow onions are in the top graph and data for the red onions are on the bottom graph. Orange arrows indicate early season insecticide applications, and blue arrows indicate late season insecticide applications. Malheur Experiment Station, 2021.

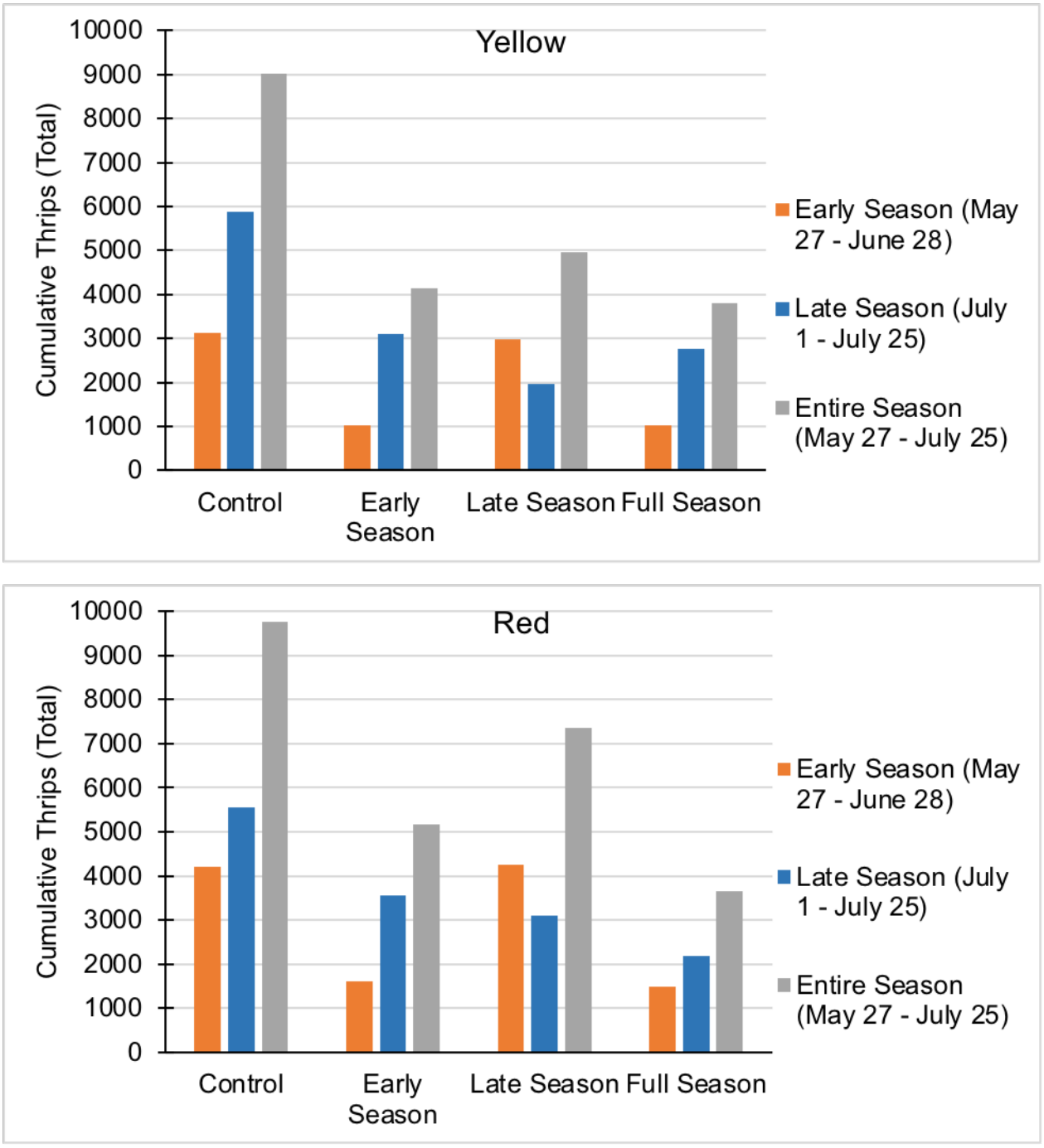

Figure 3. Total cumulative thrips for yellow onions (top graph) and red onions (bottom graph) for the four different insecticide application programs. The cumulative number from May 27 to June 28 is shown by the blue bars. The cumulative number for the period from July 1 to July 25 is shown by the orange bars. The cumulative number for the entire season is shown by the gray bars. The larger the bars, the greater the thrips pressure. Malheur Experiment Station, 2021.

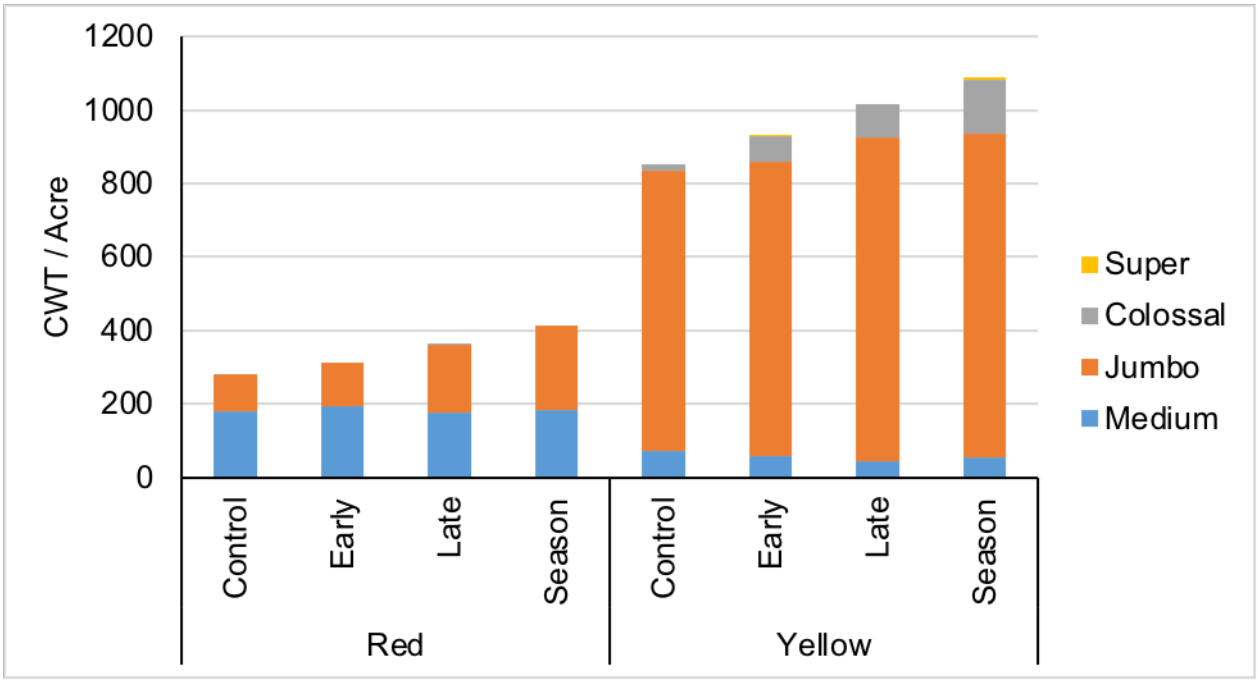

Figure 4. Marketable yield by size class for different insecticide application programs for red onions (left) and yellow onions (right). Malheur Experiment Station, 2021.