

Commercial Evaluation of Proclaim for Control of Lepidopterous Pests of Lettuce

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Abstract

Proclaim 1.6 was evaluated in head lettuce in side-by-side large plot aerial and ground application demonstrations compared to commercial standard treatments. Proclaim consistently provided excellent control of beet armyworm and cabbage looper larvae. Worm control by Proclaim was equivalent to, or better than the commercial standards.

Introduction

Beet armyworm, *Spodoptera exigua* (Hübner) (BAW) and cabbage looper, *Trichoplusia ni* (Hübner) (CL), are two of the most serious lepidopterous pest attacking lettuce in Arizona. Presently, pest control advisors (PCAs) and growers rely primarily on Lannate or Larvin tank-mixed with a pyrethroid and/or a *B.t.* to control these pests. Lannate and Larvin target BAW while the pyrethroids target CL. Within recent years, several new insecticides have begun development for worm control in lettuce. Unlike many of the products developed in the past, these insecticides are more target specific and more mundane to the environment. One of these new products is Proclaim (emamectin benzoate). Proclaim is a sister to the insecticide Agri-Mek and is also derived from the fermentation product avermectin. However, Proclaim is different in isomeric compositions which gives it its activity towards lepidopterous pests.

The objective of this study was to evaluate the efficacy of Proclaim 1.6 against BAW and CL relative to commercial standard treatments applied by ground and air in commercial settings. These tests were conducted under a non-crop destruct Experimental Use Permit (EUP) 618-EUP-14.

Materials and Methods

Three techniques were used to evaluate efficacy: a constant site evaluation, a tagged plant evaluation and a timed evaluation. Precount evaluations were made followed by evaluations at 2 and 5-7 days after treatment (DAT). The constant site evaluation was made by marking ten locations in each treatment area (Proclaim and commercial standard). Each location consisted of five consecutive plants. Each of these locations contained BAW and/or CL larvae and remained constant throughout the evaluation period. The tagged plant evaluation was made by tagging 20 individual plants that contained BAW and/or CL larvae in the Proclaim and commercial standard areas. Additionally, an untreated check was created for this evaluation technique by placing 300-ml plastic saucers, 14-cm in diameter, over individual plants containing BAW and/or CL larvae within the commercial standard area prior to application. The saucers were removed 24 hr after treatment. Each worm was monitored throughout the evaluation period to determine whether or not it died, lived or became missing. The timed evaluation was intended to simulate a pest control advisor scouting the field. Timed evaluations were conducted within each treatment by inspecting as many plants as possible in 15 minutes and counting the number of BAW and CL larvae present. Constant site and the timed evaluations were used following each applications, the tagged plant evaluation was used only following the first

application of the aerial EUP.

Because of the lack of naturally occurring BAW larvae during the second application period of the aerial EUP, each constant location site was hand infested with ten second instar BAW larvae obtained from the USDA-ARS in Stoneville, MS. Two larvae were placed between the wrapper leaves and the forming head on each of the five consecutive plants in each of the ten locations in both the Proclaim and commercial standard treated areas.

These tests were setup as commercial demonstrations, and because of logistical reasons were pseudo-replicated. Comparisons were made by comparing relative differences in mean standard errors and 90% confidence intervals.

Aerial EUP

The aerial EUP was located in the South Gila River Valley in Yuma, AZ. The site was head lettuce being grown by the Barkley Co. of Arizona.

On 15 Oct, Proclaim 1.6 was applied by air at 6.1 ozs. / acre + Silwet at 0.16 % v/v in a total volume of 10 gal. The commercial standard was Larvin 3.2 at 26.5 ozs. / acre + Dipel 2X at 1.5 lbs. / acre + Pounce 3.2EC at 6.6 ozs. / acre + Silwet at 0.16 % v/v applied by ground in a total volume of 30 gal. / acre. The lettuce was at the 7-8 leaf stage.

The second application was made on 9 Nov. Proclaim 1.6 was applied by air at 6.0 ozs. / acre + Sil-Gaurd at 0.12 % v/v in a total volume of 10 gal. The commercial standard was Mustang 1.5EW at 4.0 ozs. / acre + Xentari at 1.0 lbs. / acre + Pounce 3.2EC at 6.7 ozs. / acre + Sil-Gaurd 0.12 % v/v applied by air in a total volume of 10 gal. / acre. The lettuce was at the heading stage.

Ground EUP

The ground EUP was located near Texas Hill in Tacna, AZ. The site was head lettuce being grown by Braden Family Farms of Arizona.

On 18 Oct, Proclaim 1.6 was applied by ground at 6.3 ozs. / acre + Silwet at 0.15 % v/v in a total volume of 10 gal. The commercial standard was Lannate SP at 0.89 lbs. / acre + Thiodan at 1.27 qts. /acre + Silwet at 0.15 % v/v applied by ground in a total volume of 30 gal. / acre. The lettuce was at the 6 leaf stage.

The second application was made on 29 Oct. Proclaim 1.6 was applied by ground at 6.0 ozs. / acre + Sil-Gaurd at 0.15 % v/v in a total volume of 10 gal. The commercial standard was Lannate SP at 0.82 lbs. / acre + Xentari at 0.95 lbs. / acre + Pounce 3.2EC at 6.1 ozs. / acre + Sil-Gaurd at 0.15 % v/v applied by ground in a total volume of 30 gal. / acre. The lettuce was at the 10-12 leaf stage.

Results and Discussion

Aerial EUP

Evaluations from constant locations of five consecutive plants are presented in Figure 1 for BAW and Figure 2 for CL. There were no significant differences between treatments in numbers of BAW prior to application 1. However, the Proclaim treated area contained significantly fewer small and large BAW than the standard at 2 and 5 DAT (Figure 1). CL were more abundant in the Proclaim area prior to application, but these populations were reduced to level as low or lower than the standard at 2 and 5 DAT (Figure 2).

Based on counts from tagged plants following application 1 (Figures 3-6), at 2 DAT the Proclaim treated area contained a significantly greater percentage of dead small and large BAWs than the standard which differed only slightly from the untreated (Figures 3 & 4). By 5 DAT, the standard had significantly fewer live small BAWs than the untreated plants, but still had more than Proclaim. In the Proclaim and Standard treated areas, all of the small and large CLs were either missing or dead (Figures 5 & 6). On the untreated plants, all small and large CLs were alive

at 2 DAT, but by 5 DAT 33.3% of the small CLs and all of the large CLs were missing. Thus, both the standard and Proclaim appeared efficacious to small CLs but activity towards large CLs was difficult to discern.

Similar to the constant location and tagged plant evaluations, the timed counts give the impression that the standard treatment contained more BAWs than the Proclaim area at 2 and 5 DAT (Table 1.). However, the timed counts also suggest that more CLs appeared to be present in the standard area.

BAW and CL control in the standard and Proclaim areas appeared to be similar 2 and 5 days following the second application (Figures 7 & 8). Timed counts did not show any large differences in BAW or CL populations between the Proclaim and standard treated area (Table 2).

Overall, against BAWs and CLs, aerial applications of Proclaim appeared to be as efficacious or better than either ground or aerial applications of commercial standard treatments.

Ground EUP

CL populations were low during both ground applications of the Proclaim vs. Standard demonstration. However, BAW populations were sufficient for reliable comparisons. Following both applications 1 and 2, based on constant locations of five consecutive plants, Proclaim appeared to provide equivalent or better control of small BAW than the standard (Figures 9 & 10). Against large BAWs, there were no clear differences between treatments, probably because of the low number of large BAW present.

Similarly, when using 15 minute timed counts to compare treatments, both the Proclaim and Standard treatments appeared equally effective following applications 1 and 2 (Tables 3 & 4).

Overall, against BAWs, ground applications of Proclaim appeared to be as efficacious or better than either ground applications of commercial standard treatments.

Table 1. First application, 15 minute timed evaluation of beet armyworm (BAW) and cabbage looper (CL) eggs and larvae, lettuce 7-8 leaf stage, 1996 Aerial EUP.^a

Date	DAT ^b	Treatment ^c	BAW			CL		
			eggs ^e	sm. lar. ^f	lg. lar. ^g	eggs ^e	sm. lar. ^f	lg. lar. ^g
10/15/96	pre	proclaim	1	22	13	6	11	1
10/15/96	pre	standard	0	18	8	3	11	0
10/17/96	2	proclaim	0	0	0	0	0	0
10/17/96	2	standard	1	9	1	2	4	0
10/20/96	5	proclaim	0	0	0	3	2	0
10/20/96	5	standard	0	1	2	6	3	0

^aExperimental Use Permit (EUP) 618-EUP-14.

^bDAT - days after treatment.

^cProclaim - 5 acres treated at 6.1 ozs / acre + Silwet at 0.16% v/v, applied by air at 10 gal per acre; Standard 45 acres treated - Larvin 3.2 at 26.5 ozs. / acre + Dipel at 1.5 lbs / acre + Pounce 3.2EC at 6.6 ozs. / acre + Silwet at 0.16 % v/v, applied by ground at 30 gal per acre.

^dNumber found after 15 minutes of scouting each treatment.

^e% egg - Number of plants with one or more eggs per 15 minutes.

^fSm. lar - Number of 1st and 2nd instar larvae per 15 minutes.

^gLg. lar - Number of third, fourth and fifth instar larvae per 15 minutes.

Table 2. Second application, 15 minute timed evaluation of beet armyworm (BAW) and cabbage looper (CL) eggs and larvae, lettuce heading stage, South Gila River Valley, 1996 Aerial EUP.

Date	DAT ^b	Treatment ^c	BAW			CL		
			eggs ^e	sm. lar. ^f	lg. lar. ^g	eggs ^e	sm. lar. ^f	lg. lar. ^g
11/08/96	pre	proclaim	0	1	0	5	2	0
11/08/96	pre	standard	0	1	0	0	5	1
11/11/96	2	proclaim	0	0	0	0	1	1
11/11/96	2	standard	0	0	0	0	2	0
11/14/96	5	proclaim	0	0	0	0	3	2
11/14/96	5	standard	0	0	0	1	2	1

^aExperimental Use Permit (EUP) 618.

^bDAT - days after treatment.

^cProclaim - 5 acres treated at 6.0 ozs / acre + Sil-Gaurd at 0.12% v/v, applied by air at 10 gal per acre; Standard 45 acres treated - Pounce 3.2EC at 6.7 ozs. / acre + Xentari at 1.0 lbs / acre + Mustang 1.5EW at 4.0 ozs. / acre + Sil-Gaurd at 0.12 % v/v, applied by air at 10 gal per acre.

^dNumber found after 15 minutes of scouting each treatment.

^e% egg - Number of plants with one or more eggs per 15 minutes.

^fSm. lar - Number of 1st and 2nd instar larvae per 15 minutes.

^gLg. lar - Number of third, fourth and fifth instar larvae per 15 minutes.

Table 3. First application, 15 minute timed evaluation of beet armyworm (BAW) and cabbage looper (CL) eggs and larvae, lettuce 6 leaf stage, Texas Hill, 1996 Ground EUP^a.

Date	DAT ^b	Treatment ^c	BAW			CL		
			eggs ^e	sm. lar. ^f	lg. lar. ^g	eggs ^e	sm. lar. ^f	lg. lar. ^g
10/18/96	pre	proclaim	0	8	2	0	0	0
10/18/96	pre	standard	2	7	2	0	0	0
10/20/96	2	proclaim	0	4	1	0	0	0
10/20/96	2	standard	0	4	0	0	0	0
10/23/96	5	proclaim	1	0	0	0	0	0
10/23/96	5	standard	0	0	1	0	0	0

^a Experimental Use Permit (EUP) 618.

^bDAT - days after treatment.

^cProclaim - 4.5 acres treated at 6.3 ozs / acre + Silwet at 0.16% v/v, applied by ground at 30 gal per acre; Standard 30.5 acres treated - Lannate SP at 0.89 lbs. / acre + Thiodan 3EC at 1.27 qts. / acre + Silwet at 0.16% v/v, applied by ground at 30 gal per acre.

^dNumber found after 15 minutes of scouting each treatment.

^e% egg - Number of plants with one or more eggs per 15 minutes.

^fSm. lar - Number of 1st and 2nd instar larvae per 15 minutes.

^gLg. lar - Number of third, fourth and fifth instar larvae per 15 minutes.

Table 4. Second application, 15 minute timed evaluation of beet armyworm (BAW) and cabbage looper (CL) eggs and larvae, lettuce heading stage, Texas Hill, 1996 Ground EUP^a.

Date	DAT ^b	Treatment ^c	BAW			CL		
			eggs ^e	sm. lar. ^f	lg. lar. ^g	eggs ^e	sm. lar. ^f	lg. lar. ^g
10/29/96	pre	proclaim	0	1	0	1	0	0
10/29/96	pre	standard	0	2	3	0	0	0
10/31/96	2	proclaim	0	0	0	0	0	0
10/31/96	2	standard	0	0	0	5	0	0
11/06/96	7	proclaim	0	0	1	0	1	0
11/06/96	7	standard	1	0	1	2	0	0

^a Experimental Use Permit (EUP) 618.

^bDAT - days after treatment.

^cProclaim - 4.5 acres treated at 6.0 ozs / acre + Sil-Guard at 0.15% v/v, applied by ground at 30 gal per acre; Standard 30.5 acres treated - Lannate SP at 0.82 lbs. / acre + Xentari at 0.95 lbs. / acre + Pounce 3.2EC at 6.1 ozs. / acre + Sil-Guard at 0.15% v/v, applied by ground at 30 gal per acre.

^dNumber found after 15 minutes of scouting each treatment.

^e% egg - Number of plants with one or more eggs per 15 minutes.

^fSm. lar - Number of 1st and 2nd instar larvae per 15 minutes.

^gLg. lar - Number of third, fourth and fifth instar larvae per 15 minutes.

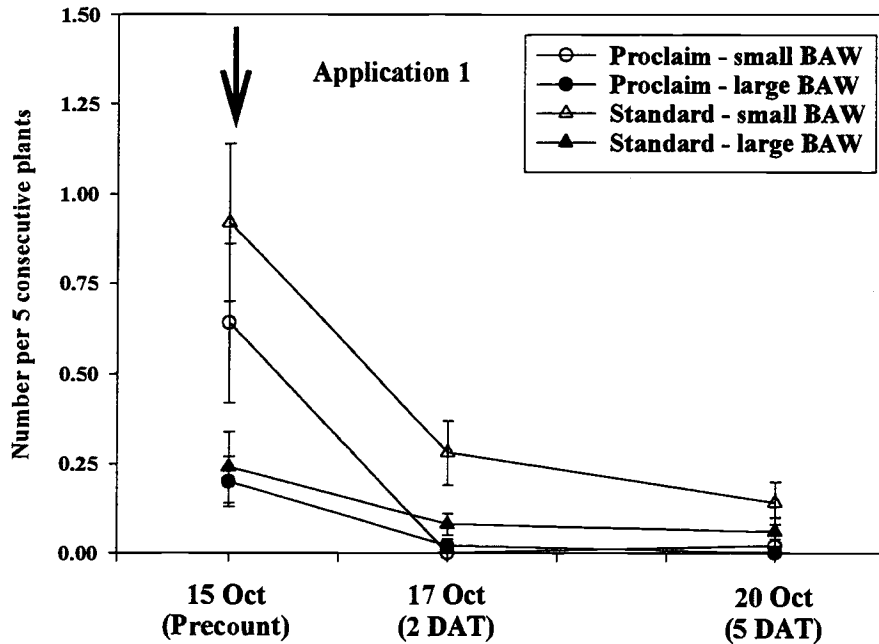


Figure 1. Number of small and large BAWs sampled from five consecutive plants replicated 10 times in each treatment regime. Proclaim - 5 acres treated at 6.1 ozs / A + Silwet at 0.16% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Larvin 3.2 at 26.5 ozs / A + Dipel at 1.5 lbs / A + Pounce 3.2EC at 6.6 ozs / A + Silwet at 0.16 % v/v, applied by ground at 30 gal of water / A.

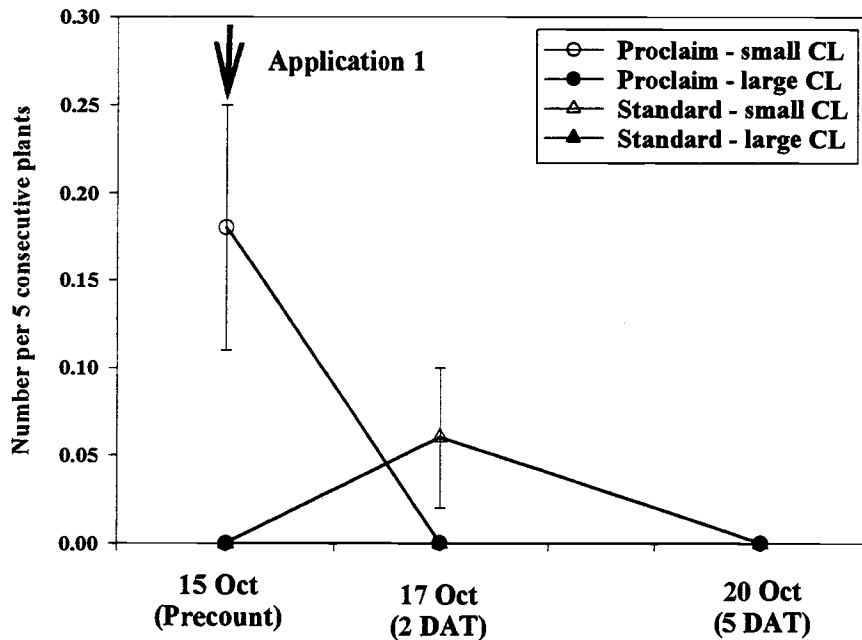


Figure 2. Number of small and large CLs sampled from five consecutive plants replicated 10 times in each treatment regime. Proclaim - 5 acres treated at 6.1 ozs / A + Silwet at 0.16% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Larvin 3.2 at 26.5 ozs / A + Dipel at 1.5 lbs / A + Pounce 3.2EC at 6.6 ozs / A + Silwet at 0.16 % v/v, applied by ground at 30 gal of water / A.

Small BAWs

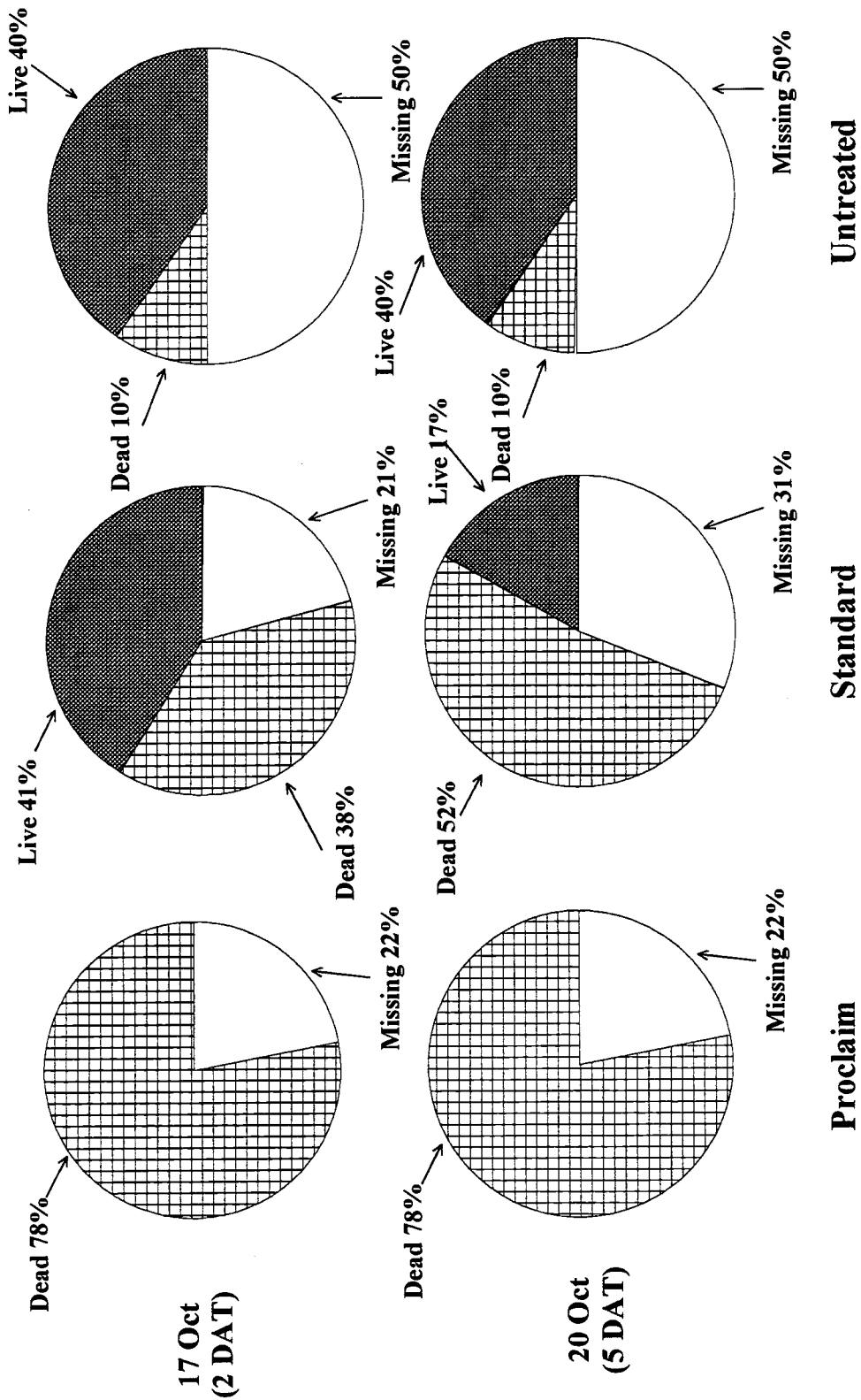


Figure 3. Percentages of live, dead and missing small BAWs sampled from individually tagged worms replicated 20 times in each treatment regime. Proclaim - 5 acres treated at 6.1 ozs / A + Silwet at 0.16% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Larvin 3.2 at 26.5 ozs / A + Dipel at 1.5 lbs / A + Pounce 3.2EC at 6.6 ozs / A + Silwet at 0.16 % v/v, applied by ground at 30 gal of water / A.

Large BAWs

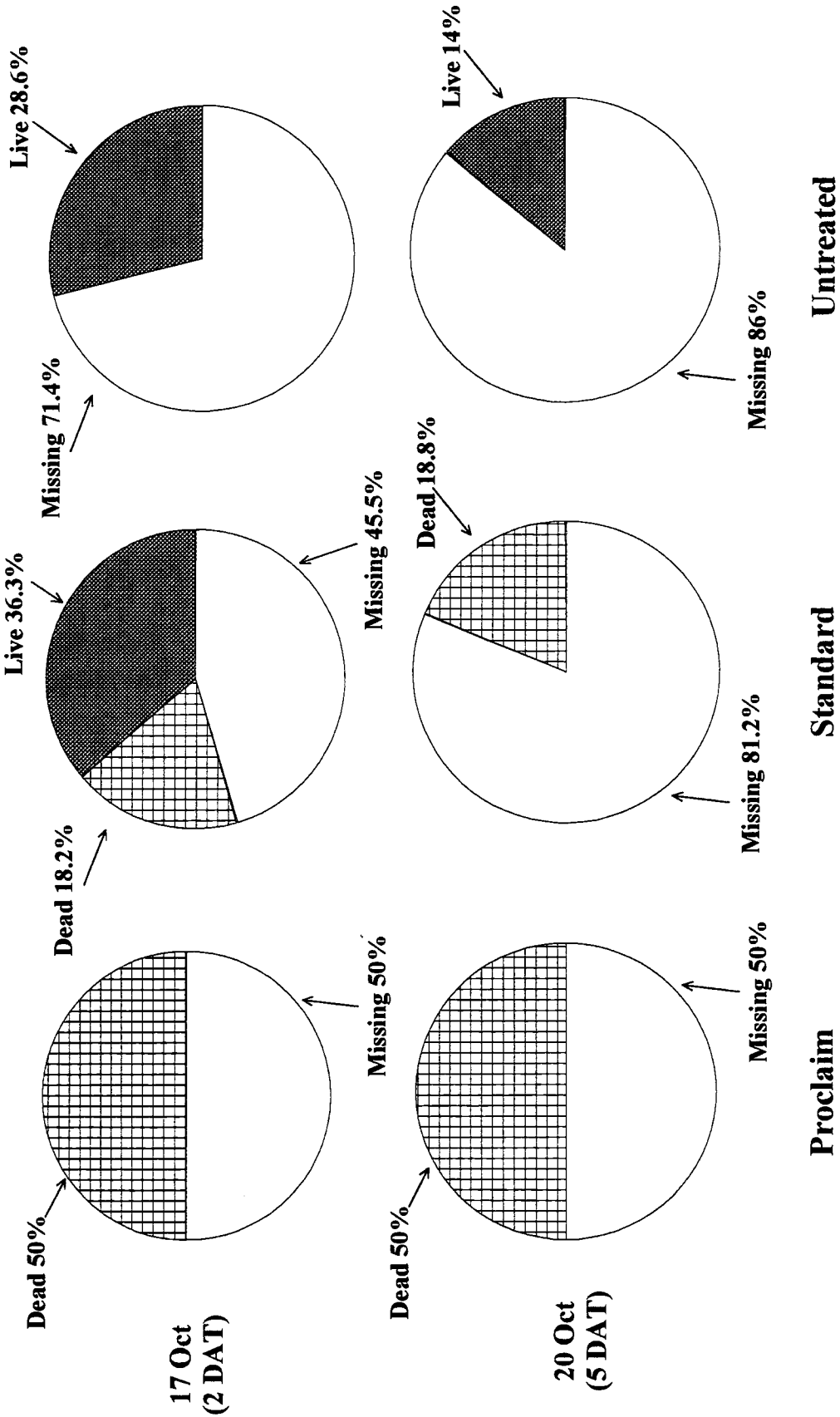


Figure 4. Percentages of live, dead and missing large BAWs sampled from individually tagged worms replicated 20 times in each treatment regime. Proclaim - 5 acres treated at 6.1 ozs / A + Silwet at 0.16% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Larvin 3.2 at 26.5 ozs / A + Dipel at 1.5 lbs / A + Pounce 3.2EC at 6.6 ozs / A + Silwet at 0.16 % v/v, applied by ground at 30 gal of water / A.

Small CLs

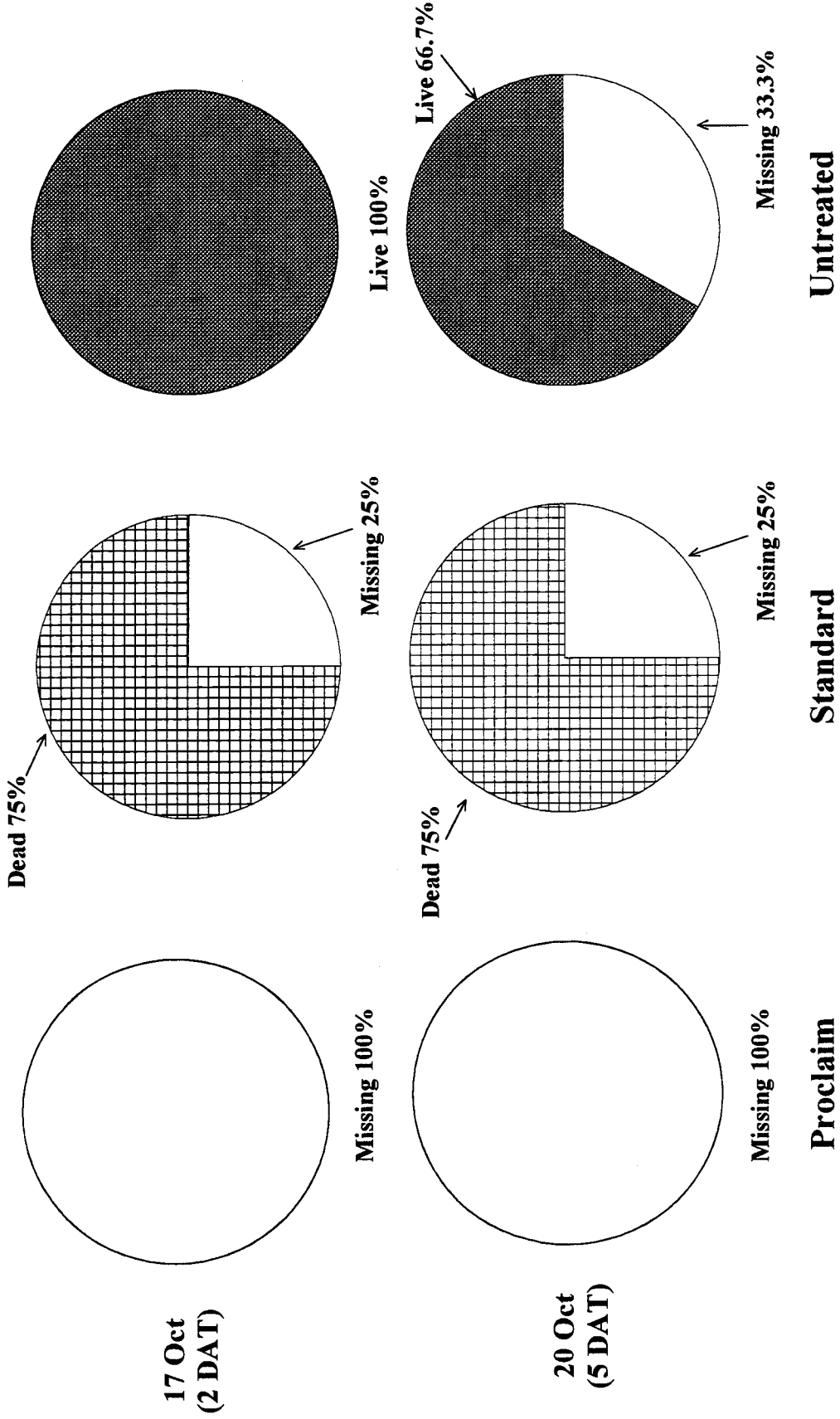
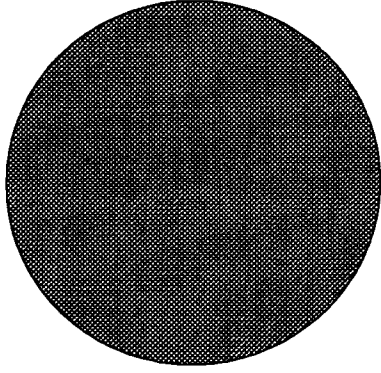
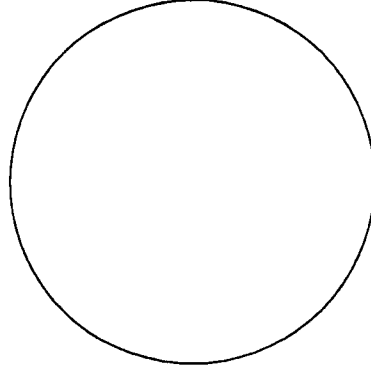


Figure 5. Percentages of live, dead and missing small CLs sampled from individually tagged worms replicated 20 times in each treatment regime. Proclaim - 5 acres treated at 6.1 ozs / A + Silwet at 0.16% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Larvin 3.2 at 26.5 ozs / A + Dipel at 1.5 lbs / A + Pounce 3.2EC at 6.6 ozs / A + Silwet at 0.16 % v/v, applied by ground at 30 gal of water / A.

Large CLs

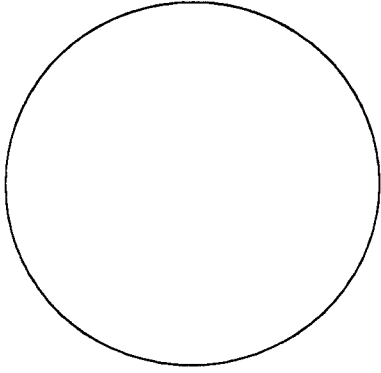


Live 100%

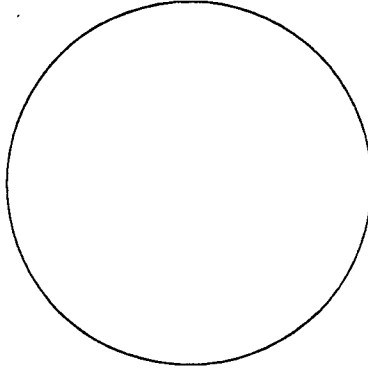


Missing 100%

Untreated

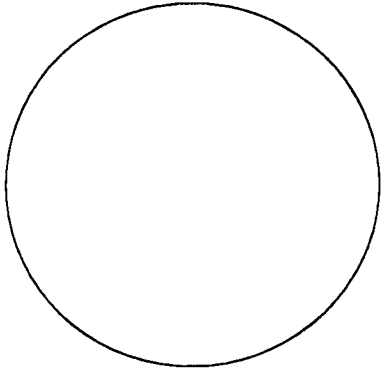


Missing 100%

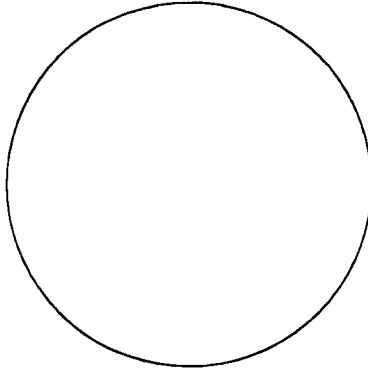


Missing 100%

Standard



Missing 100%



Missing 100%

Proclaim

**17 Oct
(2 DAT)**

**20 Oct
(5 DAT)**

Figure 6. Percentages of live, dead and missing large CLs sampled from individually tagged worms replicated 20 times in each treatment regime. Proclaim - 5 acres treated at 6.1 ozs / A + Silwet at 0.16% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Larvin 3.2 at 26.5 ozs / A + Dipel at 1.5 lbs / A + Pounce 3.2EC at 6.6 ozs / A + Silwet at 0.16 % v/v, applied by ground at 30 gal of water / A.

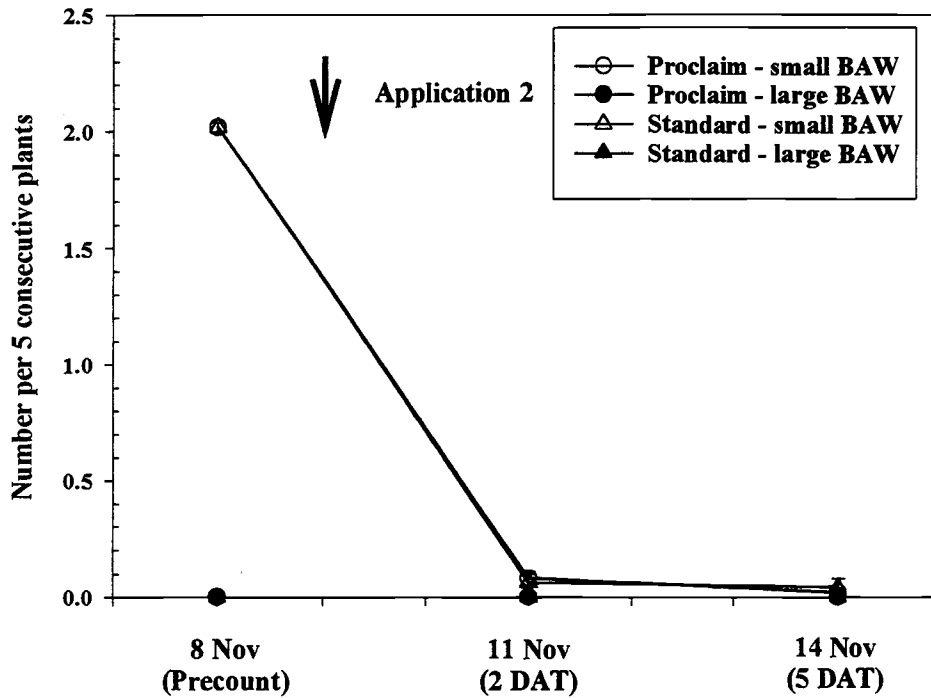


Figure 7. Number of small and large BAWs sampled from five consecutive plants replicated 10 times in each treatment regime. Proclaim - 5 acres treated at 6.0 ozs / A + Sil-Gaurd at 0.12% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Mustang 1.5EW at 4.0 ozs / A + Xentari at 1.0 lbs / A + Pounce 3.2EC at 6.7 ozs / A + Sil-Gaurd at 0.12 % v/v, applied by air in 10 gal of water / A.

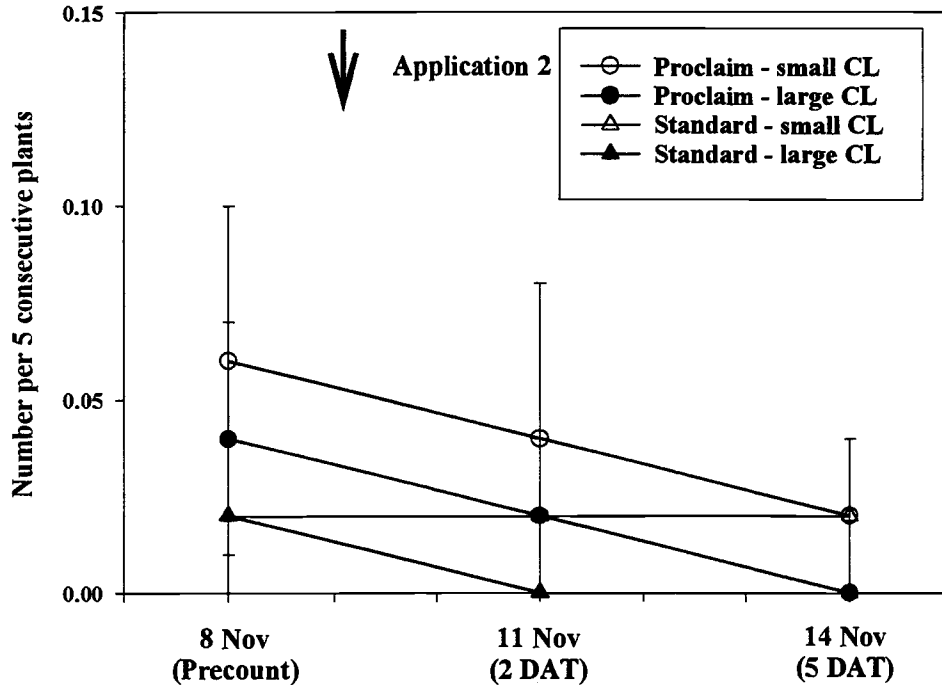


Figure 8. Number of small and large CLs sampled from five consecutive plants replicated 10 times in each treatment regime. Proclaim - 5 acres treated at 6.0 ozs / A + Sil-Gaurd at 0.12% v/v, applied by air in 10 gal of water / A. Standard - 45 acres treated with Mustang 1.5EW at 4.0 ozs / A + Xentari at 1.0 lbs / A + Pounce 3.2EC at 6.7 ozs / A + Sil-Gaurd at 0.12 % v/v, applied by air in 10 gal of water / A.

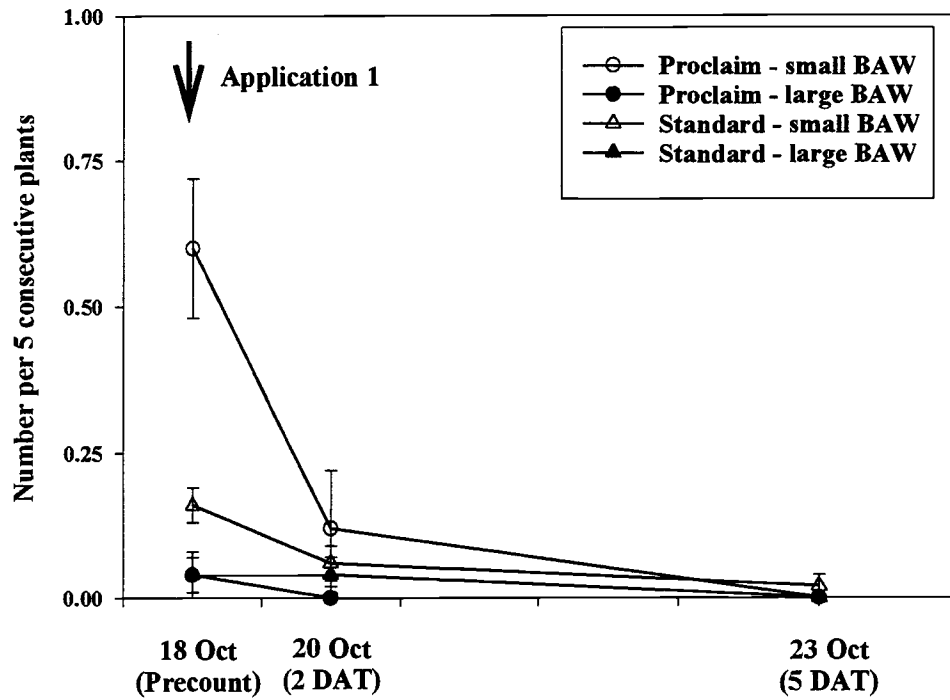


Figure 9. Number of small and large BAWs sampled from five consecutive plants replicated 10 times in each treatment regime. Proclaim - 4.5 acres treated at 6.3 ozs / A + Silwet at 0.16% v/v, applied by ground in 30 gal of water / A. Standard - 30.5 acres treated with Lannate SP at 0.89 lbs / A + Thiodan 3EC at 1.27 qts / A + Silwet at 0.16 % v/v, applied by ground in 30 gal of water / A.

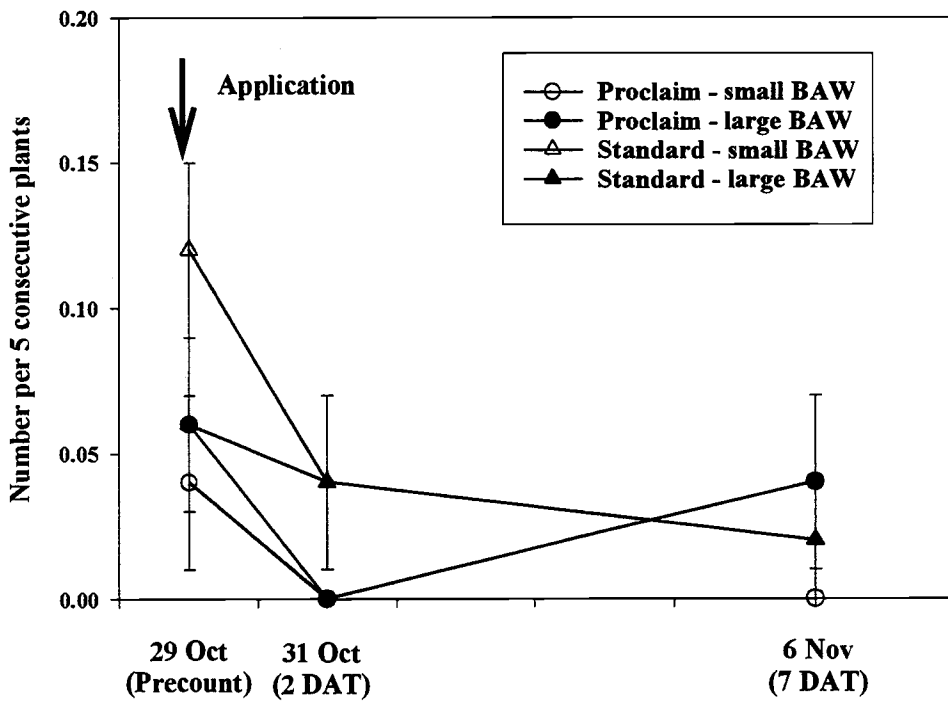


Figure 10. Number of small and large BAWs sampled from five consecutive plants replicated 10 times in each treatment regime. Proclaim - 4.5 acres treated at 6.0 ozs / A + Sil-Gaurd at 0.15% v/v, applied by ground in 30 gal of water / A. Standard - 30.5 acres treated with Lannate SP at 0.89 lbs / A + Xentari at 0.95 lbs / A + Pounce 3.2EC at 6.1 ozs / A + Sil-Gaurd at 0.15 % v/v, applied by ground in 30 gal of water / A.