

A Comparison of the Firstline® (FMC Corporation) and Sentricon® (Dow Agro Science) Termite Colony Elimination Systems Efficacy on *Heterotermes aureus* (Snyder) in Southern Arizona

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ABSTRACT

Firstline® and Sentricon® Termite Colony Elimination Systems were monitored at 20 residential home sites in Tucson, Arizona for their ability to control *Heterotermes aureus* (Snyder) infestations. Firstline® and Sentricon® Termite Colony Elimination System were each installed at 10 homes. Five of the homes were designated either as curative (having active infestations) or preventative (having no active infestation). During the 2 year study, 3 residents terminated their involvement in the Firstline®, while all of the Sentricon® Termite Colony Elimination System homes remained in the program. Mean number of days to first hit at curative homes was 84 versus 96 for Firstline® and Sentricon® Termite Colony Elimination System, respectively. Average bait consumption for the Firstline® system was 14% for the curative homes and 10% for the preventative homes. In contrast, the average bait consumption for the Sentricon® Termite Colony Elimination System was 51% for the curative homes and 58% for the preventative homes, which was significantly different at ($P < .05$).

INTRODUCTION

Baits are a relatively new alternative to the standard liquid termiticide method of barrier treatment that has been used for the last 50 years (Potter 1997). Baiting systems such as Sentricon® Termite Colony Elimination System and Firstline® were introduced in to the commercial market over the past decade and now are widely used as an alternative control method by pest control operators. Although testing on the efficacy of such systems has been reported on subterranean termites in the eastern U.S. (Su 1994; Pawson and Gold 1996), in California (Getty et.al.,1999) and Hawaii (Yates and Grace

2000), there has been little reported on subterranean termites of the Southwestern U.S.; particularly the desert subterranean termite *Heterotermes aureus* (Snyder). With the desert subterranean termite causing the most structural damage in the Southwest (Jones 1990), consumer demand continues to request information on controlling *H. aureus* in ways that reduces the application of liquid termiticides. The Sentricon® Termite Colony Elimination System and Firstline® systems have the potential to provide an alternative protection to structures against *H. aureus*.

The Sentricon® Termite Colony Elimination System and Firstline® system use essentially the same methodology in monitoring for termites, in that a hardened plastic unit containing wood "monitors" is placed around a structure (Fig. 1). However, the two systems differ in the type of active ingredient that is impregnated in the bait matrix. Sentricon® Termite Colony Elimination System uses a chitin synthesis inhibitor (hexaflumuron) while Firstline® uses a stomach poison (sulfuramide). Various authors including Grace et al. (2000) who showed the effectiveness of sulfuramide in the laboratory against *Coptotermes formosanus*, while Forschler and Chiao (1998) indicated some success with the Firstline® system against *Reticulitermes* spp. in a field setting have tested both systems. Su (1994) has shown success against the eastern subterranean termite *Reticulitermes flavipes* and *Coptotermes formosanus* in terms of nearly 100% reduction of field population using hexaflumuron. Potter et al. (2001) reported the elimination of termite colonies from 21 out of 23 houses infested with *Reticulitermes* spp. in Kentucky using Sentricon® Termite Colony Elimination System. Kistner and Sbragia (2001) found Sentricon® Termite Colony Elimination System to be fully efficacious in eliminating *Reticulitermes hesperus* infestations in Northern California.

The purpose of this study was to experimentally compare both systems to provide structural protection against *H. aureus*.

MATERIALS AND METHODS

Structures: Twenty residential structures were selected in the Tucson area for this study. Ten residential structures were used for both the Firstline® and the Sentricon® Termite Colony Elimination System. All homes except for one (Orth; Table 1) were pre-treated at

the time of construction. None of the homes had received a liquid termiticide treatment in the past 12 months. Each structure was estimated to be 12 to 16 years old, with all of the homes presented in one of four construction types; block, frame stucco, adobe or wood frame. Square footage of each structure was determined along with an estimate of the percent vegetative cover per compass direction and percent irrigated (Table 1).

Firstline: Ten residential structures were selected in Tucson for installation. Five of the homes had previous active infestations and were designated as "curative" while the other five were designated as "preventative" or having no active infestation. Firstline® is composed of cylindrical plastic stations that contain a southern yellow pine monitoring device and uses cardboard bait containing the termiticide sulfuramide (Figure 1). These stations are placed into the ground with a 3.7 cm soil augur approximately 20 cm deep and are spaced around homes at approximately 3m intervals. Stations were installed in April 1999 and were monitored monthly until April of 2001. Whenever a monitor had greater than five termites present, it was considered "hit" and a single auxiliary station was added within 25cm of the original station. The original station was then baited with a GT plus™ bait tube. The original infested wood was then placed in the auxiliary station. Termites collected from the monitor were placed around the bait tube (the tube top is childproof and cannot be opened) in order to "self-recruit" termites from the active colony. Table 2 lists the number of original and auxiliary stations installed at each house in the study. Data was taken on each station for number of "hits" (absent versus presence of tubing, or etching of the wood), and bait consumption (visual percent of bait tube consumed).

Above ground stations containing sulfuramide were placed within the structures at any time evidence of termite activity was noticed.

Sentricon®: The same process was used in the installation of the Sentricon® Termite Colony Elimination System. Using the same criteria as previously stated, there were an additional 10 houses selected in Tucson (5 preventative/5 curative). The Sentricon® System is similar to the Firstline® in that it too is a cylindrical plastic station, but the monitoring device contains two pieces of MD-499 wood and the bait is paper

impregnated with the insect growth regulator, hexaflumuron. Stations were also placed in the ground with a soil augur and were spaced around homes at approximately 3m intervals. Stations were installed in April/May 1999, and were monitored monthly until September/October, 2001 or 30 months. For the Sentricon® Termite Colony Elimination System, whenever a monitor had greater than five termites present it also was considered “hit”, two auxiliary stations were added within 25 cm of the original station. Each auxiliary station received one piece of MD-499 wood from the original station along with one new piece of wood. The original station was then baited by placing the termites from the monitor into a Recruit II bait-tube (these tube tops can be screwed off) in order to "self recruit" termites to the tubes. Table 2 lists the number of original and auxiliary stations installed at each house. Data was taken on each station for number of “hits” (absence versus presence of tubing, or etching of the wood), and bait consumption (visual percent of bait tube consumed).

Above ground stations containing hexaflumuron were placed within the structures any time activity was noticed.

RESULTS

The structures in the study all had common features that are presented in Table 1. Eight out of 10 of the Firstline® homes were frame stucco with the remaining two being wood frame and block homes. Square area of the homes ranges from 60-372m². No correlation could be established between percent irrigation and shrub coverage. Only one structure had no irrigation associated with it and shrub coverage was present around all the structures but one. The initial mean number of Firstline® preventative stations versus curative was 27 and 29.4 respectively. Upon completion of the study, auxiliary stations had increased by 3.6 and 6.4 respectively for preventative and curative home sites (Table 2). Six of the Sentricon® Termite Colony Elimination System homes were block homes with three being frame stucco and one being an adobe structure. Square area of the Sentricon® Termite Colony Elimination System homes ranged from 70-325m². Initial mean number of Sentricon® Termite Colony Elimination System bait stations installed

for preventative versus curative homes was 35.8 and 37.6 respectively, with that number increasing to 38.3 and 44.4 by the end of the study (Table 2). Mean number of days until the first bait placement at a home was around 90 days for both products at a curative site (Fig. 2). In contrast, the preventative home sites, took approximately 4 months (mean = 121) for Sentricon® Termite Colony Elimination System and nearly 6 months (mean = 177) for Firstline®.

Both the Firstline® and Sentricon® Termite Colony Elimination System were effective in obtaining termites in the stations. Although the smallest mean number of days until termites hit a station was almost three months (84 days), all of the curative houses had monitoring stations that were infested by termites at some point during the study and were baited. The percentage of stations baited at the homes is shown in Figure 3. For the Sentricon® Termite Colony Elimination System curative homes, 18% of the original stations were baited while 38% of the auxiliary stations were baited. For the Sentricon® preventative homes, 11% of the original stations were baited while 7% of the auxiliary stations were baited. In contrast, the Firstline® curative homes had 29% of the original stations baited and 47% of the auxiliary stations, while the preventative homes had 16% of the original stations baited and 53% of the auxiliary stations baited.

Where the systems largely differed was in the number and amount of bait tubes consumed. The Sentricon® Termite Colony Elimination System curative homes had 63% of the bait tubes with some consumption (at least 1%) which differed significantly from the Firstline® ($P < .05$) in which 29% of baits had some consumption (Figure 4). As for the preventative homes, the Sentricon® Termite Colony Elimination System had 81% of the baits with some consumption, which again differed significantly from Firstline® ($P < .05$) with 37% of the baits having some consumption. A comparison of the accumulated total amount of bait consumed showed there were significant differences ($P < .05$) between Firstline® and Sentricon® Termite Colony Elimination System (Figure 5). In the curative homes, Sentricon® Termite Colony Elimination System had a mean bait consumption rate of 51% (57 bait tubes) while Firstline® had a mean bait consumption of 14% (53 bait tubes). At the preventative homes, Sentricon® Termite Colony Elimination System had a mean bait consumption of 58% (36 bait tubes) while Firstline® had a mean bait consumption of 10% (28 tubes).

DISCUSSION

The effectiveness of both the Sentricon® and Termite Colony Elimination System Firstline® systems for controlling *Heterotermes aureus* should be largely determined by two factors. The first involves the abilities of the stations to obtain and/or retain termites infesting the station. Both systems in the field were able to retain termites within the bait stations. Thus the station design, wood used, and placement were all adequate for retaining termites in the stations until a bait tube could be installed. Whether the stations were able to lure termites versus simply retaining them is questionable. Preliminary lab observations (Weeks, personal. observation) suggest that *H. aureus* has sparse food detection abilities and finds food largely by chance encounters. The fact that stations adjacent to infested stations commonly remained un-infested also suggests that retention is due to encounters that are more random rather than anything to do with station design.

The second factor essential for bait station success is bait consumption itself. The Sentricon® Termite Colony Elimination System and Firstline® systems use radically different bait matrices, which, in this study, is where the two systems diverge. The Sentricon® Termite Colony Elimination System bait had a higher overall consumption rate and was consumed more frequently than the Firstline® bait. If both baits have an equal toxicity to *H. aureus*, than the Sentricon® Termite Colony Elimination System bait would be more effective. Grace et al. (2000) reported a preference of *Coptotermes* for certain bait matrices. This could have played a factor in consumption of the bait tubes by *H. aureus* in that the paper type bait used in the Sentricon® Termite Colony Elimination System is preferred to the type of cardboard used in the Firstline®.

Also important to note is that two out of the ten homes for each system had termite activity in the stations at the close of the study. In the case of the FMC curative homes, three of five were dropped from the program due to customer dissatisfaction with the program. A follow-up conversation with each customer noted failure to stop termites inside as a primary reason for quitting the program. This suggests that structural protection using either system is a long-term process and not a "magic bullet" for termite control. Seasonal changes in behavior of *H. aureus*, differing ecological characteristics

surrounding monitoring stations, and disturbance factors probably all play a role in preventing either system from being 100% effective.

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Table1. Structural characteristics, estimates of the percent of an irrigation system and the percent vegetative cover based on compass directions from the 20 structures present in the study.

Name	Treatment	m ²	Construction	% Irrigation				% Vegetative Cover			
				N	S	E	W	N	S	E	W
Bingham	Firstline	214	Frame Stucco	10	0	50	40	5	0	30	45
Demer	Firstline	195	Frame Stucco	100	0	0	50	20	15	50	50
Dhuey	Firstline	372	Frame Stucco	100	50	0	50	0	30	0	0
Ewen	Firstline	214	Frame Stucco	60	75	10	0	75	20	0	0
Fields	Firstline	251	Frame Stucco	10	50	10	0	10	10	20	0
Maglione 1	Firstline	111	Frame Stucco	20	100	0	0	20	100	0	0
Maglione 2	Firstline	60	Frame Stucco	5	80	0	15	5	80	0	15
Maglione 3	Firstline	70	Frame Stucco	20	20	0	10	0	50	0	0
Orth	Firstline	204	Wood Frame	0	0	0	0	0	10	10	0
Tennenbaum	Firstline	130	Block Frame	100	0	0	0	0	0	15	0
Atkins	Sentricon	223	Block Stucco	5	40	5	0	5	50	10	0
Baker	Sentricon	225	Frame Stucco	10	100	0	20	0	50	0	10
Cohen	Sentricon	279	Frame Stucco	75	50	20	5	75	75	10	0
Dehler	Sentricon	232	Block Stucco	0	10	25	40	0	10	15	40
Doughty	Sentricon	111	Block Stucco	0	10	90	50	0	5	20	50
Einstein	Sentricon	325	Block Stucco	75	50	75	50	75	40	75	50
Johnston	Sentricon	279	Block Stucco	75	25	0	0	20	20	0	0
Khonke	Sentricon	157	Block Stucco	50	20	0	20	50	10	0	15
OSLC	Sentricon	70	Adobe Stucco	25	0	0	0	0	0	0	0
Snyder	Sentricon	278	Frame Stucco	80	80	80	80	60	70	50	75

Table 2. Number of original, auxiliary and total stations for both preventative and curative structures surrounded with Firstline ®.

Name	Type	Original	Auxiliary	Total
Bingham	Preventative	29	2	31
Ewen	Preventative	38	3	41
Fields	Preventative	29	1	30
Maglione 2	Preventative	20	12	32
Maglione 3	Preventative	19	0	19
MEAN		27		30.6
Demer	Curative	28	5	33
Dhuey*	Curative	43	4	47
Maglione 1	Curative	25	7	32
Orth***	Curative	28	12	40
Tennebaum**	Curative	23	4	27
MEAN		29.4		35.8

- *Dropped out 6/01 after 25 months
- ** Dropped out 12/00 after 18 months
- *** Dropped out 8/01 after 27 months

Table 3. Number of original, auxiliary and total stations for both preventative and curative structures surrounded with Sentricon ® Termite Colony Elimination System.

Name	Type	Original	Auxiliary	Total
Atkins	Preventative	30	10	40
Baker	Preventative	37	9	46
Johnston	Preventative	38	4	42
Khonke	Preventative	33	0	33
Snyder	Preventative	41	2	43
MEAN		35.8		40.8
Cohen	Curative	46	13	59
Dehler	Curative	36	8	44
Doughty	Curative	35	10	45
Einstein	Curative	55	26	81
OSLC	Curative	16	9	25
MEAN		37.6		50.8

Figure 1- Sentricon Termite Colony Elimination System® and Firstline ® bait stations

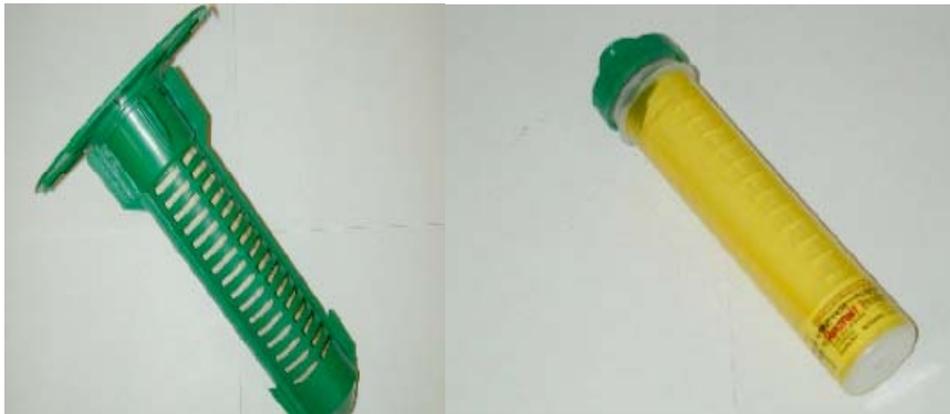
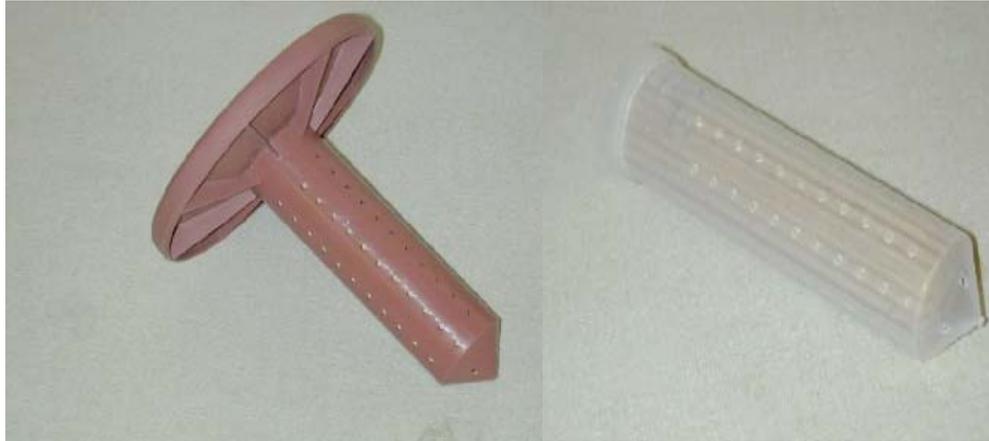


Figure 2 - Mean number of days to first baiting

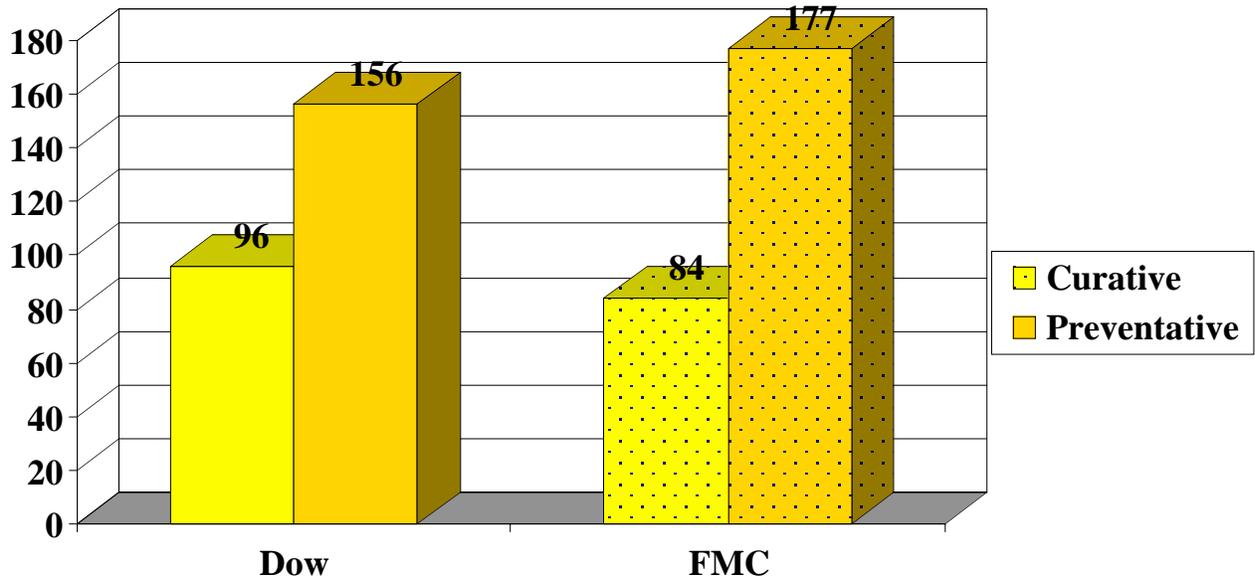


Figure 3 The percentage of stations baited

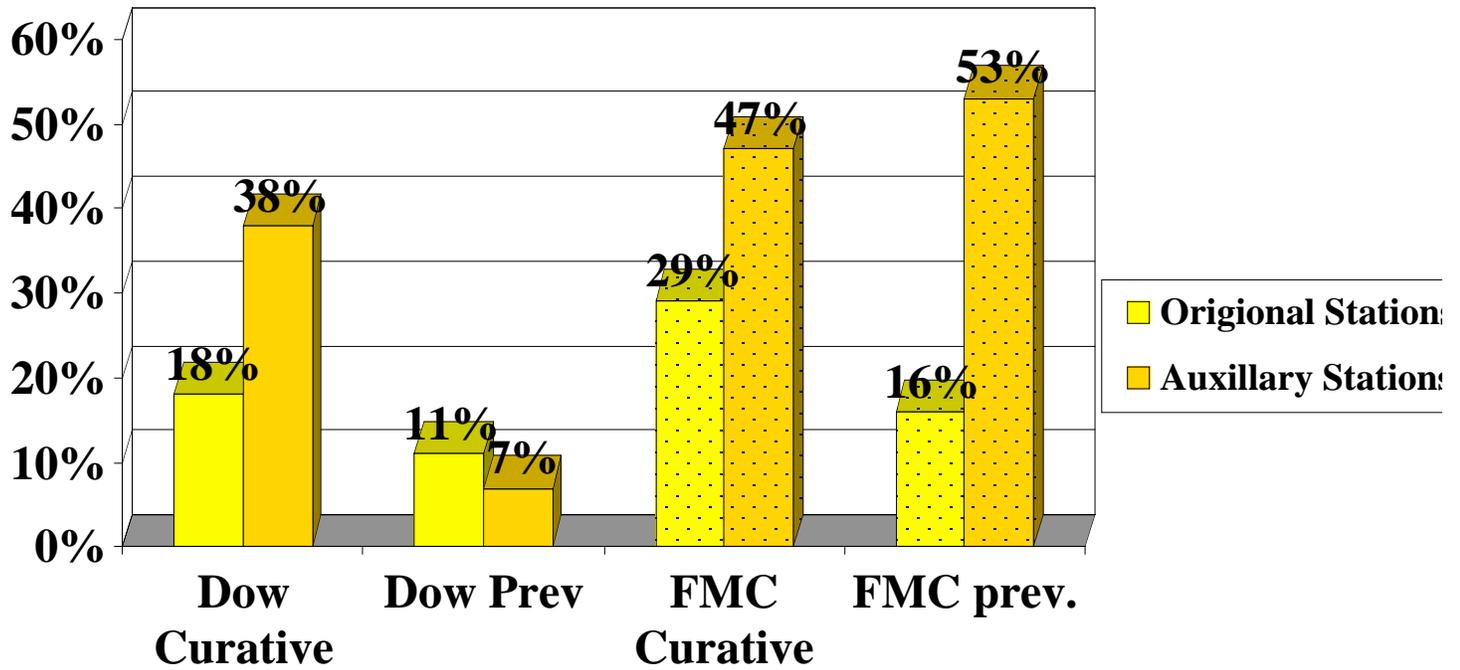


Figure 5- Accumulated Totals of the Bait Consumed

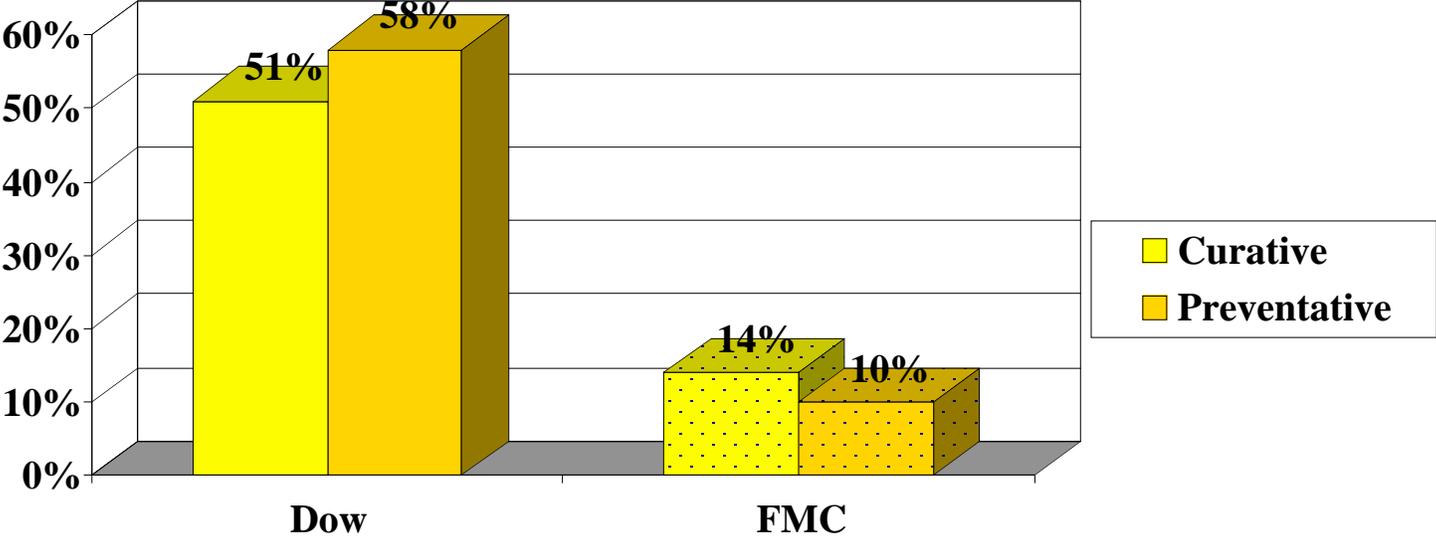


Figure 4 - Bait Consumption of at least 1%.

