

## **PALATABILITY, DURATION, AND ELIMINATION PERIOD OF HIGH DENSITY SENTRITECH BAITS, TESTED WITH RETICULITERMES GRASSEI AND RETICULITERMES BANYULENSIS**

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**Abstract** We tested a new SentiTech formulation of refined cellulose bait matrix containing hexaflumuron 0.5% to eliminate *Reticulitermes grassei* and *Reticulitermes banyulensis*, using 3-month monitoring and bait-replenishment interval, during 4 years in 40 sites in Spain, and compared the results against the SentiTech commercial baits present in the Spanish market in that moment. The aim was to test if both matrix formulations offer similar hit rate and time to connect with termites, if they achieve the elimination of colonies in similar period of time, and if consumption is similar in both cases. Results show similar hit rate of the new formulated matrix, significant reduction of time to connect with the colony, much less bait consumed during the elimination period, and reduction of the elimination period. Our data also show that extending the monitoring and bait-replenishment period to 180 days during the elimination period does not impact negatively colony elimination when using the new matrix bait. Longer service intervals and faster elimination can have significant advantages to pest controllers in terms of planification of resources and cost reductions.

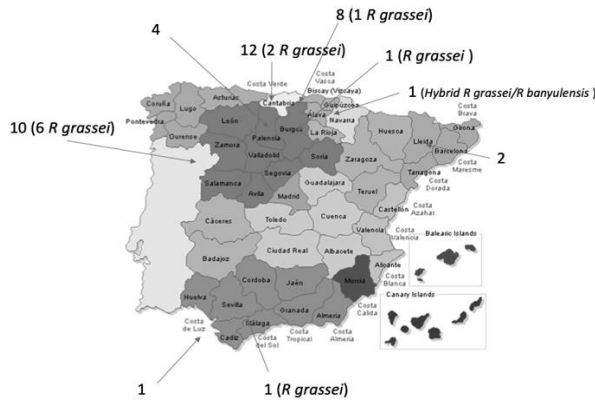
**Key words** *Reticulitermes, grassei, Reticulitermes banyulensis*, bait, hexaflumuron

### **INTRODUCTION**

*R. grassei* and *R. banyulensis* are the two species of subterranean termites currently present in the Iberian Peninsula and Balearic Islands. Such is the importance of the damages that they produce in Spain, that in 2016 the AENOR committee for wood protection published the "Protocol of action in urban areas affected by underground termite attacks"(UNE 56418:2016), intended to serve as a basis for the treatment of this xylophagous insects for the City Councils and other public entities. Populations of subterranean termites can be suppressed by using a baiting program to deliver an active ingredient that is both slow-active and non-deterrent (Su and Scheffrahn 1993)<sup>(1)</sup>. Hexaflumuron is a benzoylphenyl urea chitin synthesis inhibitor, formulated on a cellulose bait matrix registered as RECRUTE PRO (0.5% hexaflumuron) in Spain. This formulation, named Recruit II in United States, was tested globally for termite colony elimination by Su<sup>(2)</sup> and Vargo<sup>(3)</sup> in 2003. Monitoring devices and baits in these trials were usually evaluated monthly and replenished as needed at monthly intervals. A new refined cellulose bait matrix (High-Density or HD from now on) was developed by Dow AgroScience in 2004. Our aim is to test if use of baits of HD matrix using the same IGR concentration as the commercial product (hexaflumuron 0.5%) (i) offers similar acceptance to *R. grassei* and *R. banyulensis*, (ii) eliminates colonies in similar period of time, (iii) and can extend monitoring and replenishment intervals for 1 to 3 months without adverse consequences to colony elimination. The results of this experiment show that HD baits (i) are equally accepted by termites to the commercial formulation, (ii) time to eliminate the colony is reduced, and (iii) one visit every 3 months to monitor and replenish the baits is sufficient to eliminate the colony. The use of this new formulation can have significant advantages to pest controllers as longer service intervals and shorter elimination period can allow better planification of resources and cost reductions.

## MATERIALS AND METHODS

In this project, we tested HD baits in 40 different test locations spread over Spain, making sure that all termite species present on these areas were covered. We focused most of our tests locations on North Spain as this is the region where colonies of termites show less voracity and abandon rates are higher, based on our previous observations.

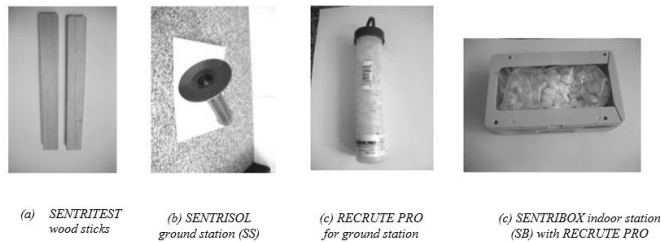


**Figure 1.** Test locations on Spanish territories.

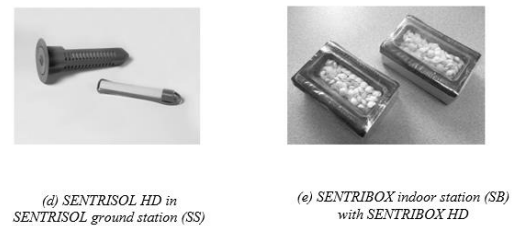
We requested the contribution of Pest Control Organizations (PCOs from now on), that contributed in the following way: (i) each site installed and inspected by commercial PCO, (ii) quarterly (3 months) inspection visits reported electronically on an individual file « Plantilla de revisiones » accessible on Web site «Sentrigraph », (iii) samples collected of termites for DNA analysis. Each individual file of visit was consolidated in a single file per

location with site description. Each single file per location reported on an Excel database with calculation of critical data: % connection in SS and SB (defined below), time to first connection, time to elimination (as defined below), bait consumption, calculation of means and standard deviation, DNA analysis for species identification.

In this experiment, the following biocidal products were used: SENTRISOL HD (Biocides registry 16-30-08351), SENTRIBOX HD (Biocides registry 17-30-08895), RECRUTE PRO (Biocides registry 16-30-01329).



**Figure 2.** Materials for commercial sites.



**Figure 3.** Materials for experimental sites.

**Election of sites.** Criteria: locations with visible termite activity inside the house to have the possibility of placing (c) and (e), locations with access to the ground surface to place (b) and (d), size of ground level <math><200\text{ m}^2</math>. No termiticide or other termite bait will be applied during the test nor should it have been applied in the last 5 years prior to the test on the chosen sites.

**Inspection of structures.** All structures were completely inspected at least twice during the tests: the first before the installation of the bait stations, to detect active areas for the placement of the bait stations, and the second 3-6 months after the elimination of infestation.

**Installation.** For experimental sites, SS contained SENTRISOL HD from their installation. For commercial sites, SS contained monitoring by wooden sticks, that were replaced by RECRUTE PRO in the case of termite detection. All SS were installed around the outside of each building at intervals of approximately 3 meters and a maximum of 5 meters from the structure to protect the perimeter. SB placed where termite activity is determined, containing SENTRIBOX HD in the case of experimental sites and RECRUTE PRO in the case of commercial sites. In all sites, termite samples were collected for species identification by DNA, in the case of experimental sites.

**Reviews - Data collection.** For experimental sites: (i) every 45 days, for the sole purpose of measuring relative humidity. (ii) Every 3 months to inspect each SS or SB station. At each quarterly visit, baits could be moistened if necessary and the bait could be replaced if consumed in more than 75%.

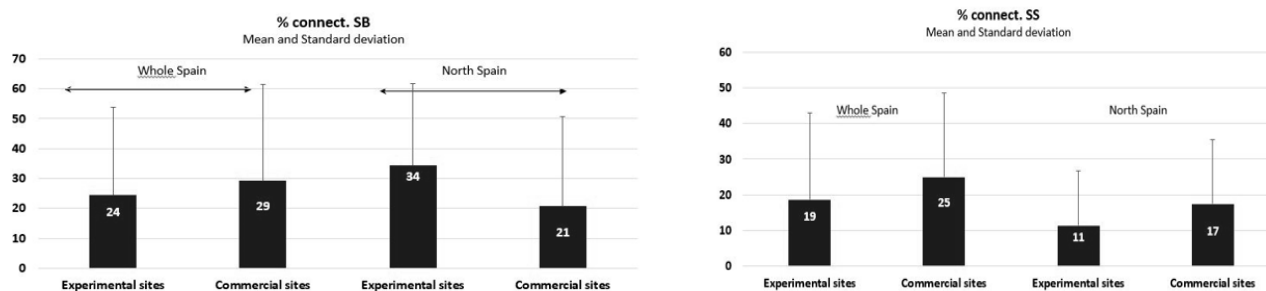
For commercial sites: visits every 30-45 days during elimination period for the purpose of inspecting each ground and indoor station. Each station was to be opened and the same data recorded. The colony is considered eliminated if there is no presence of termites in the baits, there is no consumption of the baits since previous visit, there is no termite activity inside the structure, and no swarming, making sure that all the above is still being fulfilled in the next spring.

**Statistics.** Based on this all, 2 databases of 40 trials for experimental sites and 80 trials for commercial sites were created. The standard deviation has been the measure to quantify the amount of dispersion of the set of data values. In all graphs included along this paper, mean values will be depicted as bold bars including them within the bars themselves, while the standard deviation will be displayed on top on such bars as thin lines.

**Regional grouping.** As per our previous observations with commercial baits, termite behavior can differ between regions: termites on the North show less consumption of bait and higher abandon rates. Therefore, results were grouped as follows: North (Biscay, Cantabria, Navarra), East (Catalonia), Center (Zamora, La Rioja), South (Andalucía: Cádiz, Málaga) and whole Spain. Valid comparison only for North and Center as South had 12 commercial sites vs 2 experimental sites, and East had 0 commercial sites and 2 experimental sites.

### RESULTS AND DISCUSSION

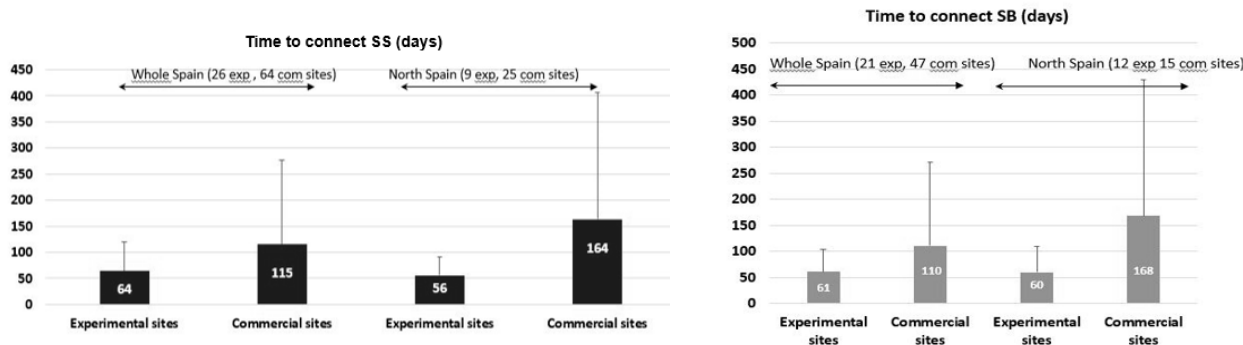
Results were collected for all regions, combining cases in which only SB was used, only SS was applied, and both SB and SS were utilized.



**Figure 4, 5.** Percentage connection in station with SB and SS in whole vs. North Spain

Hit rate in SB is very similar between commercial product and HD product, and between North Spain and whole Spain. Hit rate in SS is slightly lower (not significant) between HD and wood monitors. This is more pronounced in the North. Sites with only SS: 2 sites in Cantabria and 1 site in Burgos from the PCO “Montañesa de Desinfección” with no hit in SS HD. According to PCO, termites were present in the past but not now, indicating no issues with HD. We have results from 1 SB only site, where we ran 1 trial successful for both products. 3 sites with HD in Biscaya from the PCO “Abando” with no contact were placed -10 years after chemical treatment- and no issue with HD was reported.

**Time to connect (interval between installation and termite activity in bait station).** Time to connect SS is significantly shorter in whole Spain and North Spain (around 60 days)..Time to connect SB significantly shorter with HD in whole Spain and in North Spain (average 60 days).

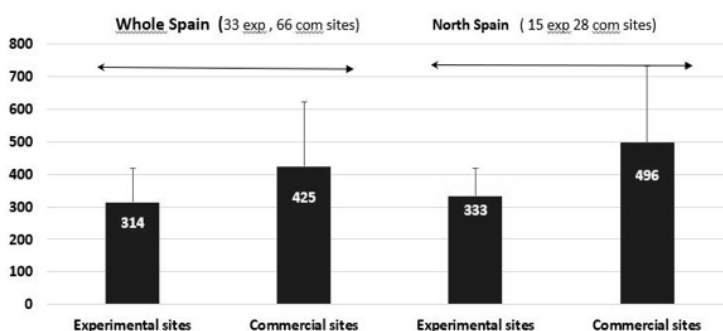


**Figure 6,7.** Time to connect with SS and SB in whole vs. North Spain.

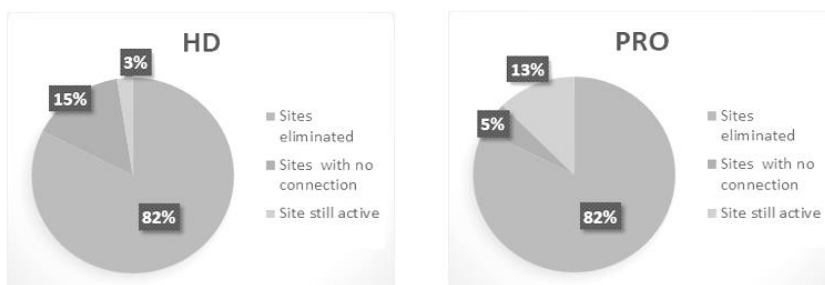
**Consumption.** Data not very precise as PCOs fill boxes with 0, 0-25%, 25-50%, 50-75% > 75%. No Bait « refusal » as was observed in the past with commercial bait formulation on *R. grassei*. A very clear trend is observed: much less bait change with HD material, leading to less visits needed.

**Table 1.** Average percent consumptions.

	<i>SS HD</i>	<i>SB HD</i>	<i>SS with PRO</i>	<i>SB with PRO</i>
Average % consumption (min - max)	44 (25 - 75)	44 (25 - 75)	54 (25 - 90)	56 (25 - 90)
Sites where bait was changed	1 (4%)	2 (10%)	14 (31%)	31 (59%)



**Figure 8.** Time for elimination in whole vs. North Spain.



**Figure 9.** Active sites details after 1 year.

Time for elimination with HD is shorter (-4 months) in the whole Spain, and this trend is pronounced (5.4 months) in North Spain. With commercial bait, elimination can be long, 13% of the sites in the database were not eliminated at +/- 1 year. With HD, elimination is faster, only 1 site remained active but the number of sites with no connection is higher.

**DISCUSSION**

The findings above can be economically important for PCOs. Extending the monitoring and bait-replenishment period from 30-45 days to 180 days during the elimination period, with no adverse impact in colony elimination allows longer service intervals. Longer service periods and a shorter elimination period may have significant advantages to pest controllers in terms of planification of resources and cost reduction. Also, High Density matrix leading to fewer replenishments means less frequent disruption of stations for termites and may result in a lower abandon rate and better control of the colony.

In summary, we ran a study of 40 experimental sites vs. 80 commercial sites, with all known types of subterranean termites present in Iberian Peninsula and Balearic Islands. This is the largest database in Europe. The

species (*R. grassei* and *R. banyulensis*) were confirmed by DNA analyses. We also found a colony of a hybrid specie between *R. grassei* and *R. banyulensis*.

We concluded that: Average hit rate is similar between HD baits and commercial bait, with slight difference between regions. Time to connect in SB and SS significantly shorter with HD baits than with commercial bait (– 60 days in whole Spain and most regions), and even shorter with HD on North (60 days vs 160 days). Baiting at installation with HD baits results in significant reduction of time to connect to the colony. As to Consumption, no bait refusal or station abandonment with HD baits, as was also observed with commercial baits. Much less bait consumed, meaning that intervals of visits can be reduced. Time for elimination is 4 Month less with HD baits than with commercial baits (< 1 year). Some sites with commercial baits still active after 2 to 3 years while the maximum was 1.5 year for HD baits. The use of HD baits reduces time of elimination, leading to cost savings for PCOs.

### ACKNOWLEDGEMENTS

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