Cockroach gel bait performance depends at least as much on both the attractiveness and palatability of the gel as it does on the potency of the active ingredient, reveal detailed studies by BASF Pest Control Solutions.

What’s more, the appeal of baits can vary widely between different cockroach species and different parts of the world, putting the onus firmly on quality formulation based on a thorough understanding of local pest behaviour for the most consistent performance.

“It’s also important to appreciate that gel bait uptake can be very different under laboratory and field conditions,” explains BASF senior technologist, Roland Twydell. “Especially so where hygiene is less than ideal, alternative food sources are widely available and extremes of heat and humidity present particular challenges.

Only well-fed cockroaches used

“That’s why we always conduct our trials with well-fed cockroaches and give them access to a familiar alternative foodstuff and a good water supply alongside test baits,” adds insect trials specialist, Margaret Hammond. “We also complement our lab work with testing under real field conditions.”

BASF gel bait development trials underline the extent to which both bait attractiveness and palatability can vary even under controlled laboratory conditions. Evaluations of 10 different non-toxic formulations against a standard bait in a series of recent tests, for instance, show the proportion of bait consumed by the same population of German cockroaches in 24 hours varying from just over 20% to almost 75% (Fig. 1).

Interestingly too these trials reveal that it isn’t always the most initially attractive baits that prove the most palatable. Indeed, the formulation that stood out for the most complete 24 hour consumption was actually one of those least readily consumed in the first hour.

“This underlines the critical difference between attractiveness and palatability,” explains Roland. “It’s easy to attract cockroaches with the right odour or flavouring, but the bait needs to keep them eating to ensure the greatest number of individuals consume a lethal dose of insecticide. And if it does so the aggregation pheromones produced by the early feeders have a multiplier effect, serving to attract and arrest greater numbers of individuals.”

Noticeable differences

“Assessing the same formulations in parallel trials with other cockroach species further highlights the noticeable differences between them,” he reports. “In general, Oriental cockroaches tend to be shyer initial feeders
than German cockroaches. American cockroaches are by far the most inquisitive, altogether bolder and less selective in their tastes.

“We also know that German cockroaches in America, in particular, can have quite different appetites to those over here in Europe. So we have to formulate gels to reflect this.”

Preventing bait aversion

Roland continues: “In addition, aversion to glucose-containing baits has become an issue in the USA and one which we need to do everything we can to prevent this side of the Atlantic. A combination of the most potent actives and most palatable baits to ensure maximum efficacy will minimise the opportunity for aversion to develop through natural selection.

“In fipronil (Goliath) we have by far the most potent active available (Fig. 2) but we still need to employ it in sufficient concentration and incorporate it into a sufficiently palatable bait if we are to ensure the most complete and consistent control.

“Worryingly, we’re now seeing generic fipronil formulations in other parts of the world at concentrations only a fifth of the level our research has established as optimal. Significantly cheaper they may be as a result but usage and consumption levels need to be very much higher to achieve the same result, putting even more pressure on formulations which also have to meet a number of other usability criteria.”

Lessons from 10 years of work

So what characteristics have Roland Twydell and his BASF team found to be especially important in cockroach gel baits during the 10 years or more they’ve worked with quality baits like Goliath?

The source of protein and source and variety of carbohydrates and sugars are, they have no doubt, the main keys to ensuring consistently rapid and complete gel bait uptake. Interestingly, nutritional level, as well as taste, appears to be a significant consideration in maximising cockroach palatability; as is a significantly greater attractiveness than alternative food sources.

At the same time a delicate balance needs to be struck in consistency and adherence. Gels must be sufficiently sticky to stay where they’re put without running, even on smooth, vertical surfaces. While cockroaches generally prefer softer foodstuffs, however, they shy away from baits that are too sticky, presumably for the danger they pose to rapid movement.

Margaret Hammond points out that the right level of firmness is important for ease of application: “Gels that are too firm are difficult to dispense from the tube. On the other hand, if they’re too runny there’s much more of a risk of overdosing and waste.

“They need to remain both palatable and effective over an extended period too. In practice it is unlikely cockroaches will discover all the bait points straight away so they must last. As well as not drying out too much, they have to have good resistance to mould so they can be used in kitchens where both temperatures and humidity levels are often high.

“Also crucial are consistent active ingredient distribution throughout the bait; gel stability over a long shelf life; low visibility for use in sensitive areas; and a human taste deterrent. And finally, of course, baits need to be manufacturable. After all, it’s no good having the best formulation in the world if it can’t be produced reliably and consistently to the required standards,” she adds.

Bait production standards

Based on the company’s extensive cockroach baiting experience around the world, BASF Pest Control Solutions sets a number of critical standards for quality gel bait production.

Roland continues by explaining: “In a premium quality bait like Goliath Gel we’re looking for a reliable 100% kill in less than four days100% kill of German cockroaches when evaluated in our laboratory choice test arena. And we want bait that’s..."
been down for 20 weeks to still give 100% kill within seven days.

“No moulding within seven to eight weeks at 35°C and 70-80% relative humidity is another key standard of ours. At the same time, we believe a quality bait should lose less than 10% of its chemical active and experience no loss of either palatability or efficacy over a shelf life of at least five years.

“In meeting these criteria, we must appreciate that the balance of every one of the many ingredients we use in our gel baits is vital to their performance. It’s equally vital we don’t rest on our laurels. Although it’s known to exist with some other insecticide actives, we’ve yet to see any evidence of practical resistance to fipronil in cockroach populations.

“However, the US experience teaches us we need to keep using the most potent insecticides in the most palatable baits if we are to minimise the risk of aversion – and the extra bait formulation challenges it presents – developing. At the same time, we must be continually alert for any changes in either sensitivity or feeding behaviour so we can nip any potential issues in the bud through continual bait development before they become problematic,” he concludes.
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