



Old damage (brown) on ripe virescence fruits



Fresh wound caused by rat feeding on ripe nigrescence fruits (left), and ripe virescence fruits (right)

## Stalk of fruit bunches



Part of the fruit stalk chewed off by rats



Large amount of fruit stalk tissue chewed by rats



A rat nest built by cutting green pinnae and piling them above fruit bunches



Rat nests indicated by piles of dry pinnae above fruit bunches



Loose fruits found under frond piles indicating rat feeding



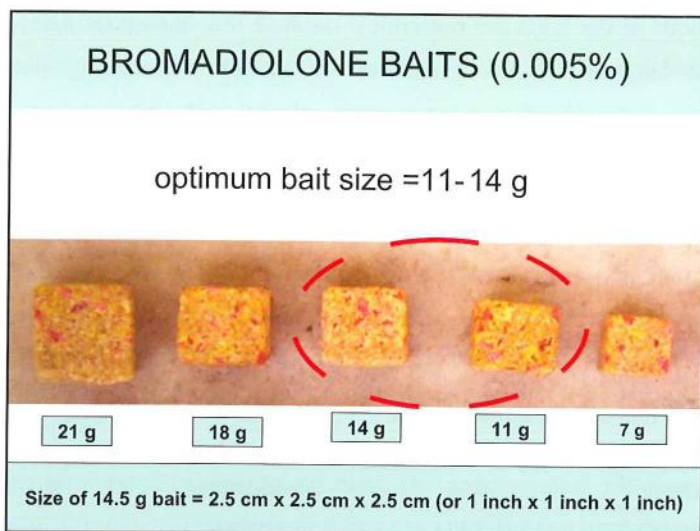
Feeding platform of rats on frond bases of young palm



Stomach contents of *Sundamys muelleri* showing the bulk is oil palm mesocarp fibres



Stomach contents of *Rattus tiomanicus* trapped in rice field consist of green colour vegetative materials



### **Baiting techniques**

In the case of using acute poison rat baits, several rounds of blank baits (no poison) are applied first to get the rats accustomed to feeding. This is known as prebaiting. Subsequently, 1 or 2 rounds of actual baiting are carried out using the poisoned baits. Unsuspecting rats consuming the baits in sufficient amount are killed rapidly. Survival can be high because rats may "sample" the baits, get a sub-lethal dose (but with adverse effect) and so warn them against further consumption.

In the case of multiple feeding using first generation anticoagulant poison baits, rats will continue eating the baits until the lethal dose is reached. Baits taken are replaced in 4 day rounds. In the more potent second generation anticoagulant poison baits, a lethal dose is attained with lesser amount of bait consumed. These baits are labeled as single feed rat baits because some rats are killed after ingesting only 1 bait. However, in practice, bait replacement is required at 4 day intervals or usually 7-10 day intervals (recommended by manufacturers). In a series of bioefficacy trials evaluating baits containing bromadiolone, flocoumafen, brodifacoum, the 4 day replacement intervals were superior to the longer 7-8 day replacement intervals. Bait replacement stops at 20% (*i.e.* 80% baits not taken) which is an indication of successful rat control. This is equivalent to a low number of rat trapped (either 0 or very few) and the % palm with

fresh damage on fruit bunches is 0 to 1% (assessment in 50 palm plot).

In general 4 types of baiting techniques are practiced in oil palm estates. These are briefly described below:

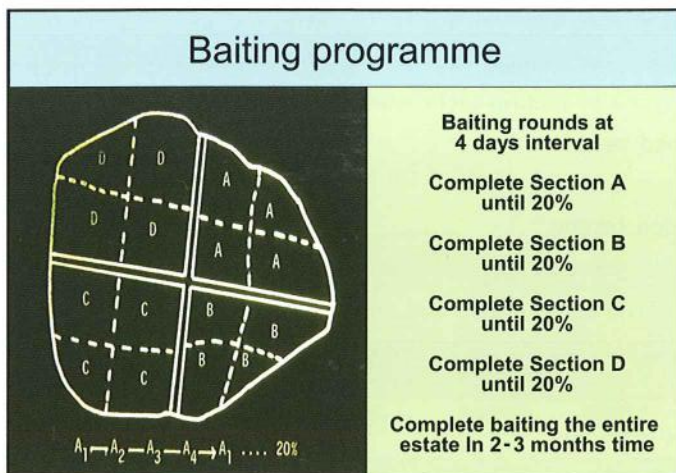
### 1) Saturation baiting

All anticoagulants require regular feeding over a period of time. Therefore more than requirement is given. This technique is usually called "saturation" or "surplus" baiting. Checking and replenishing baits are carried out at least once a week.

### 2) Standard baiting

One bait is placed at 1 station (at each palm or every 9 m apart). Checking and replenishing bait taken are carried out 4 day intervals until 20% replacement. At 20% replacement, there are very few rats in a plot of 50 palms (0 rat or very low rat number). It may be difficult to complete baiting a large plantation in 4 day intervals. The estate can be divided into sections and each section can complete baiting in 4 day intervals, i.e. each sub-section baiting until 20% bait acceptance or replacement is achieved. Then baiting moves on to another section one by one until the entire estate is completed.

Standard baiting		
Bait	warfarin, 0.05%, 15 g	brodifacoum, 0.003%, 10-15g or bromadiolone, 0.005%, 10-15g
Bait placement	1 bait per palm, all the palms and all the rows (100% baiting density)	1 bait per palm, all the palms and alternate rows (50% baiting density)
Bait replacement	4 days	4 days
Stop baiting	20% replacement	20% replacement



### 3) Pulse baiting

Second generation anticoagulant poison baits are classed as "single feed" anticoagulants. However, most rats must feed several times before dying. Checking and replenishing bait are carried out at every 7-10 day intervals. The idea is to wait for all the rats which had taken the poison baits to die first before applying fresh baits. A fixed number of baiting rounds, such as 3-4 rounds is often recommended, otherwise baiting stops at 20% replacement.

Pulse baiting		
Bait	Brodifacoum, 0.003%, 4 g	Flocoumafen, 0.005%, 4 g
Bait placement	1 bait per palm, all the palms and all the rows (100% baiting density)	1 bait per palm, all the palms and all the rows (100% baiting density)
Bait replacement	7 - 10 days	7 days
Stop baiting	3 - 4 rounds	20% replacement
Source: rat baits product labels		

### 4) XX baiting

This term is coined to denote baiting which does not following the product usage recommendation by the estate. More often, one bait per palm is applied for 1 or 2 rounds. Sometimes 2 or 3 baits per palm are applied. In some estates, a combination of the fewer rounds and multiple baits is practiced.