Integrated Pest Management for Subterranean Termites

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• “…using all available tools to prevent and control pest infestation,” (S. Kells, Univ. of Minnesota)
• “…different IPM definitions…from academia …and regulators…” causes public confusion, and PMP industry needs to create a universal definition of IPM (F. Andorka, Editor, Pest Control)
• “….offer control without pesticides…” (S. Tvedten, PMP)
• “…pesticides are part of IPM…” (A. Feuer, PMP)

“(some) groups now use the term IPM to justify their continued heavy use of pesticides in pest control…” (Pimentel, D. 1997. Techniques for Reducing Pesticide Use)
Integrated Pest Management

• IPM represents a philosophy rather than a specific control measures (Dent 1992)
• A pest control measure is justified only when ‘the density of the pest at which the loss through damage exceeds the cost of control’ (Mumford & Norton 1984)
• A cost-benefit issue
IPM for Subterranean Termites?
(Su & Scheffrahn 1998. *IPM Reviews* 3: 1-13)

- An IPM program for subterranean termites is not just a mixture of individually ineffective tools.
- The overall objective of an IPM program should be the *protection of a structure* from subterranean termite populations using the most *cost-effective* methods.
  - It is probably unrealistic to apply the cost-benefit model …for agricultural IPM directly to an urban pest management program…. (however) the underline concept of IPM to use a cost-effective approach to solve pest problem… is the same.
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Cost-Benefit Structure for Subterranean Termite IPM
(Su & Scheffrahn 1998. *IPM Reviews* 3: 1-13)

- Potential damage (D) > Fee (F)
- F = T (total operation cost) + P (net profit)
- Total operation cost (T)
  - T = l + m + e + r + o
  - l: labor, m: materials, e: equipment, r: risk, o: overhead
- D > l + m + e + r + o + P
- Most difficult to predict: D and r (risk) cost
Subterranean termite damage
Subterranean termite damage potential
Cost-Benefit Structure for Subterranean Termite IPM
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- Potential damage ($D$) > Fee ($F$)
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  - $T = l + m + e + b + o$
  - $l$: labor, $m$: materials, $e$: equipment, $b$: risk, $o$: overhead
- $F = T + P$ ($P$: net profit)
- $D > l + m + e + r + o + P$

- **Most difficult to predict:** $D$ and $r$ (risk) cost
- $D \approx$ termite population density, conducive conditions, etc.
  - More termites, larger $D$, less termites, smaller $D$
  → Population management targeting at colony level
- $r \approx$ quantity and quality of insecticide use
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= FST

= R. flavipes
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Basic Unit of Control Target in the Population Management of Subterranean Termites

- Colony

- Not an individual termite
LEGEND

LOGS AND STUMPS IN SOLID WHITE, OR NO COLORING IF REDUCED TO SHELL.
NUMBERS INDICATE DEPTH IN INCHES.
VARIANCE IN GALLERY WIDTH IS INDICATED BY VARYING WIDTHS OF LINES.
INDICATES GALLERY WAS NOT TRACED FURTHER
   " EXPLORATORY GALLERY.
   " VERTICAL SHAFT.
   " LIVING TREE.
   " ROOT.

Subterranean foraging gallery system of *C. formosanus* in Lake Charles, LA, 1967.
Area A
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Risk potentials for applying large quantity of potent, persistent liquid insecticides in soil near a home
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- **Most difficult to predict:** D and **r (risk)** cost
- **D** \( \approx \) termite population density, conducive conditions, etc.
- **r** \( \approx \) quantity and quality of insecticide use
  - Less persistent, less toxic insecticide used at smaller quantity
  \( \Rightarrow \) Less **r (risk)**
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- D ≈ termite population density, conducive conditions, etc.
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  - Less r (risk)
Current Practices for Subterranean Termite Control in the United States

- **Background** -

- **Comparison of pesticide use volume (per hectare)**
  - Agriculture: 2.17 kg (Pimentel & Levitan 1986)
  - Liquid termiticides: 39 kg (at 0.1% solution) (La Fage 1986)
  - Termite baits: 0.065 kg (Sentricon data), 600-fold less than liquid termiticides
Current Practices for Subterranean Termite Control in the United States - A Reality Check -

- Current termite control market and practices (2004)
  - Liquid termiticide: >80% market share
  - Termite baits: 25-30% market share
  - Vast majority of soil termiticide is applied for new buildings as mandate by building code; many of which may be unnecessary
  - No or little efforts for cultural control or better construction practices
  - Most homeowners are unaware of termite damage potential, control practice, etc, and typically rely on PMPs to make treatment decisions
Current Practices for Subterranean Termite Control in the United States
- A Reality Check -

• What is the answer??
  – Outreach education program to promote grass-root awareness for IPM targeting reduced-pesticide practice and termite population management
  – Area-wide population management program