Lists of Pesticides Useful for Cocoa

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IPARC

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http://www.dropdata.org
CABI survey in Africa was in 2007 (50% non-approved)
Published lists of pesticides for cocoa, compliant with market requirements

### INSECTICIDES

<table>
<thead>
<tr>
<th>S/NO</th>
<th>TRADE MARK</th>
<th>ACTIVE INGREDIENT</th>
<th>CLASS</th>
<th>FORMULATION</th>
<th>TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Danban</td>
<td>Chlorpyrifos 48%</td>
<td>Organo-Phosphate</td>
<td>Emulsifiable Concentrate (EC)</td>
<td>Minds</td>
</tr>
<tr>
<td>2</td>
<td>Actara</td>
<td>Thiamethoxam 25%</td>
<td>Neonicotinoid</td>
<td>Wettable Granule (WG)</td>
<td>Minds</td>
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### FUNGICIDES

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<tbody>
<tr>
<td>1</td>
<td>Rodmil Gold</td>
<td>Metalaxyl-M 66%</td>
<td>Phenylamide</td>
<td>Wettable Powder (WP)</td>
<td>Black Pod Disease</td>
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<tr>
<td>2</td>
<td>Funguran-OH</td>
<td>Copper Hydroxide</td>
<td>Hydroxide</td>
<td>Wettable Powder (WP)</td>
<td>Black Pod Disease</td>
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<td>3</td>
<td>Nordox 75 WP</td>
<td>Copper Oxide</td>
<td>Oxide</td>
<td>Wettable Powder (WP)</td>
<td>Black Pod Disease</td>
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<tr>
<td>4</td>
<td>Champ D.P</td>
<td>Copper Hydroxide 75%</td>
<td>Hydroxide</td>
<td>Wettable Powder (WP)</td>
<td>Black Pod Disease</td>
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### HERBICIDES

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<tr>
<td>1</td>
<td>Touchdown Forte</td>
<td>Glyphosate</td>
<td>Soluble</td>
<td>Concentrate</td>
<td>Weeds</td>
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<tr>
<td>2</td>
<td>Round up</td>
<td>Glyphosate</td>
<td>Soluble</td>
<td>Concentrate</td>
<td>Weeds</td>
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### STORAGE

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<tbody>
<tr>
<td>1</td>
<td>Actelic 25 EC</td>
<td>Pirimphos Methyl</td>
<td>Emulsifiable</td>
<td>Concentrate</td>
<td>Beans</td>
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</tbody>
</table>

### BANNED PESTICIDES PRIOR INFORMED CONSENT (PIC) LIST

1. Binacapril
2. Captafol
3. Chlorothalonil
4. Chlordieneform
5. DDT
6. Dieldrin
7. Dinoseb & Dinoseb Salts
8. Ethylene Dichloride
9. Fluoreacetamide
10. Hepachlor
11. Lindane
12. Parathion
13. Methyl Parathion
14. Phosphamidon
15. Monochlorophos
16. Methamidophos
17. Chlorobenzilate
18. Toxaphene
19. Pentachlorophenol
20. Ethylene Oxide
21. HCH (Mixed isomers)
22. EDB (1,2-dibromo-3-chloropropane)
23. 2,4,5-Trichlorophenol
24. DNOC and its salts
25. Methyl bromide
26. 4,6 Dinitro o-cresol
27. Diquat dibromide
28. Phosphine
29. Hexachlorocyclohexane
30. Atrazine
31. Alachlor
32. Atrazine + Triazine
33. Propachlor
34. Ethazal®
35. Chlorpyrifos
36. Methomyl
37. Carbaryl
38. Flumethrin
39. Lambda-cyhalothrin
40. Methoxychlor
41. Dieldrin
42. Methomyl
43. Etoxazole
44. Fenoxaprop-p-ethyl
45. TPPA
46. Parathion-methyl
47. Tetramethrin
48. Lambda-cyhalothrin + Lambda-cyhalothrin
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95. Lambda-cyhalothrin + Lambda-cyhalothrin + Lambda-cyhalothrin
96. Lambda-cyhalothrin + Lambda-cyhalothrin + Lambda-cyhalothr
Criteria for inclusion in “Strategic list”
(effectively recommendations
- Manual appendix 3A)

- Proven efficacy in at least two cocoa growing countries in the region
- ... and registered there
- Should be supported by (pref. refereed) **EVIDENCE** in the literature
- **Does not belong to WHO/EPA toxicity Class I** (preferably III or better)
- On annexes of 149/2008/EC, etc.
B. Compounds to be used with great CAUTION (limited time span, restricted markets, etc.)

- have permitted MRLs / TMRLs in some markets, but not others and/or …
- may be phased out within 2–3 years, but …
- have shown demonstrable efficacy in at least one regional cocoa growing country
- do not belong to WHO/EPA toxicity Class I
  - Examples: organo-phosphorus (OP) compounds - diazinon, chlorpyrifos ethyl, pirimiphos methyl
Phenylpyrazoles

- Discovered by Rhone-Poulenc in 1987: then Bayer, now BASF
- MoA similar to organo-chlorines
- Highly potent at very low rates of application: field application rates 10–80 g/ha

- Broad spectrum activity vs. agricultural pests … good against termites, registered in Indonesia for CPB
- Now registered for mirid sprays in 2 African countries
- Controversial NTO effects and environmental fate?
- Spraying not permitted in EU
- MRL is less than default: 0.005 ppm
Would it be appropriate to place some NNI insecticides (e.g. imidacloprid) in category B: ‘Recommend/use with great caution’ (until more data available)?

Discuss please
## Bee toxicity

<table>
<thead>
<tr>
<th></th>
<th>bee oral tox. (μg/bee)</th>
<th>bee contact (tox. μg/bee)</th>
<th>MRL (EU): (ppm)</th>
<th>MRL (Japan): (ppm)</th>
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<tbody>
<tr>
<td><strong>nitro(guanidine)-substituted neonicotinoids</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>clothianidin</td>
<td>0.0038</td>
<td>&gt;0.044</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>imidaclorpid</td>
<td>0.005 - 0.07*</td>
<td>0.018 - 0.024*</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>thiamethoxam</td>
<td>0.005</td>
<td>0.024</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>cyano-substituted (pyridylmethylamine) neonicotinoids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>acetamiprid</td>
<td>14.5</td>
<td>8.1</td>
<td>0.1</td>
<td>(0.01)</td>
</tr>
<tr>
<td>thiacloprid</td>
<td>17.3</td>
<td>38.8</td>
<td>0.05</td>
<td>0.02</td>
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<tr>
<td><strong>phenylpyrazole</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>fipronil</td>
<td>0.004</td>
<td></td>
<td>0.005</td>
<td>0.01</td>
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</tbody>
</table>

*: various studies

in brackets: default MRL
C. Lists of experimental control agents for possible future inclusion in category ‘A’

- On 91/414/EC Annex 1 (or pending)
- Subject to current or recent field tests and could well conform to criteria in category ‘A’
- Do not belong to WHO/EPA toxicity Class I and are preferably in Class III or better

Examples:
- Novel neonicotinoids and IGRs
- Carboxylic acid amides (CAA) *e.g.* dimethomorph (DMM)
- Mycopesticides and pheromones?
- Novel agents against stored products pests?
**Insecticide Mode of Action: “28 ways to kill insects & mites”: A key to effective insecticide resistance management**

**Moulting & Metamorphosis**
- **Group 18** Ecdysone agonist / disruptor
- Diacylhydrazines (e.g., Tebufenozide)
- **Group 7** Juvenile hormone mimics
- JH analogues, Fenoxycarb, Pyriproxyfen, etc.

**Midgut**
- **Group 11** Microbial disruptors of insect midgut membranes
- Toxins produced by the bacterium *Bacillus thuringiensis* (Bt): Bt sprays and Cry proteins expressed in transgenic Bt crop varieties (specific cross-resistance sub-groups)

**Metabolic Processes**
- Many groups acting on a wide range of metabolic processes including:
  - **Group 12** Inhibitors of oxidative phosphorylation, disruptors of ATP
  - Diafenthiuron & Organotin miticides
  - **Group 12** Uncouplers of oxidative phosphorylation via disruption of H proton gradient - Chlorfenapyr

**Nervous System**
- **Groups 1A & B** Acetylcholinesterase (AChE) inhibitors
- Carbamates and Organophosphates
- **Group 2** GABA-gated chloride channel antagonists
- Cyclodiienes OCs and Phenylpyrazoles (Fiproles)
- **Group 3** Sodium channel modulators
- DDT, pyrethroids, pyrethrins
- **Group 4A** Acetylcholine receptor (nAChR) agonists
- Neonicotinoids
- **Group 5** nAChR agonists (Allosteric) [not group 4A]
- Spinosyns
- **Group 6** Chloride channel activators
- Avermectins, Milbemycins
- **Group 22** Voltage dependent sodium channel blocker
- Indoxacarb

**Non-specific MoA**
- **Group 9** Compounds of non-specific mode of action (selective feeding blockers)
- Pymetrozine, Fionicamid, etc.

**Cuticle Synthesis**
- **Groups 15 and 16** Inhibitors of chitin biosynthesis
- Benzoylureas (Lepidoptera and others), Buprofezin (Homoptera)

**Non-specific MoA**
- **Group 10** Compounds of non-specific mode of action (mite growth inhibitors)
- Clofentezine, Hexythiazox, Etoxazole

**Metabolic processes**
- **Group 20** Mitochondrial complex III electron transport inhibitors
- Acequinocyl, Fluacrypyrim, etc
- **Group 21** Mitochondrial complex I electron transport inhibitors
- Rotenone, METI acaricides
- **Group 23** Inhibitors of lipid synthesis
- Tetronic acid derivatives

**IRAC website: www.irac-online.org**
D. Pesticides that MUST NOT BE USED for cocoa

Recorded as used on cocoa but have been rejected by major importing countries (usually, but not always, for good toxicological/ecotoxicological reasons).

- e.g. organochlorines (DDT, lindane, endosulfan)
- Now most OPs and carbamates
Role of insecticide mixtures?

- Promotion of formulations to OECD standards
  - Pyrethroid – neo-nicotinoid mixtures by 2 CropLife companies
  - Older pyrethroid – OP (chlorpyrifos)
- Ostensibly IRM
- Impact on pollinators and NEs?
- Real benefit to farmers?
2) Most mixtures are not primarily used for purposes of insect resistance management (IRM).

4b) Mixtures with components having the same IRAC mode of action classification are not recommended for IRM.

http://www.irac-online.org/content/uploads/IRAC_Mixture_Statement_v1.0_10Sept12.pdf
Pesticide AI lists: Appendix 3 (2007 edition had 2 categories)

A. ‘Strategic list’ for key pests: EU / Japanese / US import tolerances & evidence of efficacy
B. Compounds to be used with great CAUTION (limited time remaining, etc)
C. Lists of experimental and other potentially useful control agents
D. Pesticides that MUST NOT BE USED for cocoa

Regular updates on:
http://www.dropdata.org/cocoa/cocoa_SPS_blog.htm
Summary

There are perverse consequences of ignoring pesticide issues

- Continuing use by large proportion of farmers
- Lack of skills; inappropriate application equipment
- Research vacuum: little impartial pesticide science done on cocoa since early 1990s ...

Pesticide product lists:

- Trend is fewer, less toxic compounds: improved safety; but products getting more expensive
- Farmers may only use 1-2 MoA against individual pests
- Can efficacy of existing control practices be maintained?
- Need for rigorous protocols for evaluating new products

Need for greater transparency