

Agrochemical Analysis Sub-group Report

November 8th, 2011

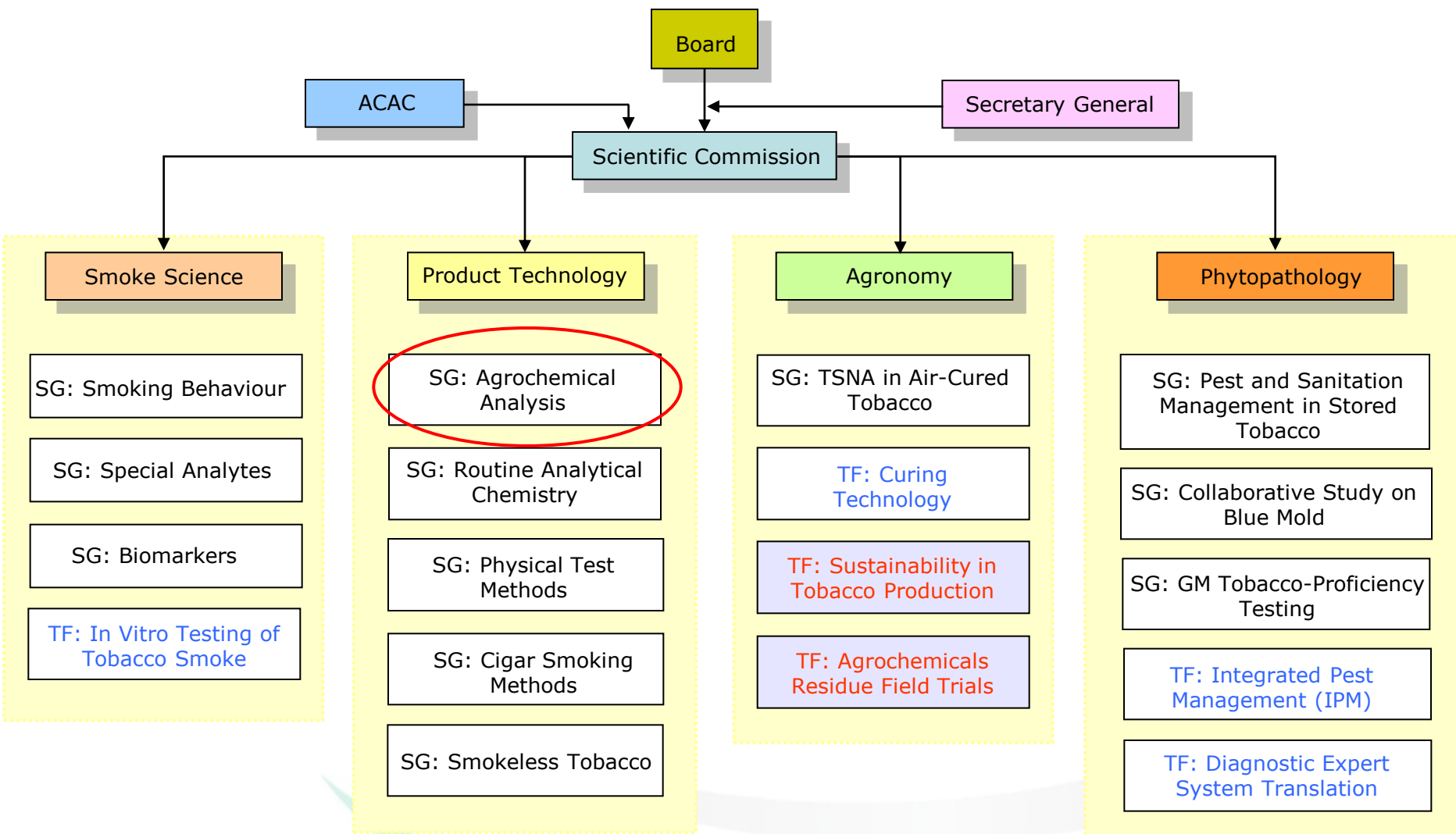
Santiago - Chile



Objectives

- 1) To perform regular [Proficiency Testing of Multi-Residue Methods](#) for the analysis of agrochemical residues on tobacco
- 2) Undertake [Joint Experiments](#) to resolve unanswered questions arising from proficiency tests; to expand knowledge base on agrochemical residues and their analysis
- 3) Produce and maintain a series of [Technical Notes](#) (on different agrochemical residue classes and selected individual compounds) to supplement the [Technical Guideline](#) and aid method development and improvement

CORESTA Agrochemical Analysis Sub-group





2011 Activity

- CORESTA-FAPAS Proficiency test FT07
- Joint Experiment Test Study
- Degradation Study
- Technical Notes
- Technical Guideline review (CORESTA Guide N° 5)
- Sub-group meeting Bergerac (France) July 19-20, 2011

Objective 1: MRM Proficiency Testing



CORESTA-FAPAS Proficiency Test

- ❑ FAPAS = Food Analysis Performance Assessment Scheme ("The Food and Environmental Research Agency", York, UK)
- ❑ Proficiency Test N° 7
- ❑ 24 laboratories from 15 countries
- ❑ 20 spiked agrochemicals on blank tobacco residue free
- ❑ FAPAS Report FT07
- ❑ Collection of analytical methods used by the participant laboratories

Objective 1: MRM Proficiency Testing



FT07 Participant Laboratories

	Laboratory	Country
1	Analytica Alimentaria GmbH	Spain
2	Bioensaios	Brazil
3	CHELAB S.R.L.	Italy
4	China National Tobacco Quality Supervision & Test Center	China
5	Eurofins Analytik GmbH - Dr. Specht Lab	Germany
6	Eurofins Food & Agro Sweden AB	Sweden
7	Food and Consumer Product Safety Authority	Holland
8	Fytolab	Belgium
9	Global Laboratory Services, Inc.	USA
10	ITC R&D Centre	India
11	Japan Tobacco, Inc.- Tochigi	Japan
12	KT&G	Korea
13	Kutzaga Tobacco Insitute	Zimbabwe
14	Labor Friedle GmbH	Germany
15	LAnART	Argentina
16	Microbac Laboratories, Inc.	USA
17	Oekolab-JTI	Austria
18	Premium Tobacco (Thailand) Ltd	Thailand
19	PT H.M. Sampoerna Tbk.	Indonesia
20	Reemtsma Cigarettenfabriken GmbH	Germany
21	Souza Cruz SA	Brazil
22	UFAG Laboratorien AG	Switzerland
23	Unviversidade Federal de Santa Maria	Brazil
24	USDA-AMS-S&T-FLS	USA
25	Zhengzhou Tobacco Research Institute of CNTC	China

Objective 1: MRM Proficiency Testing



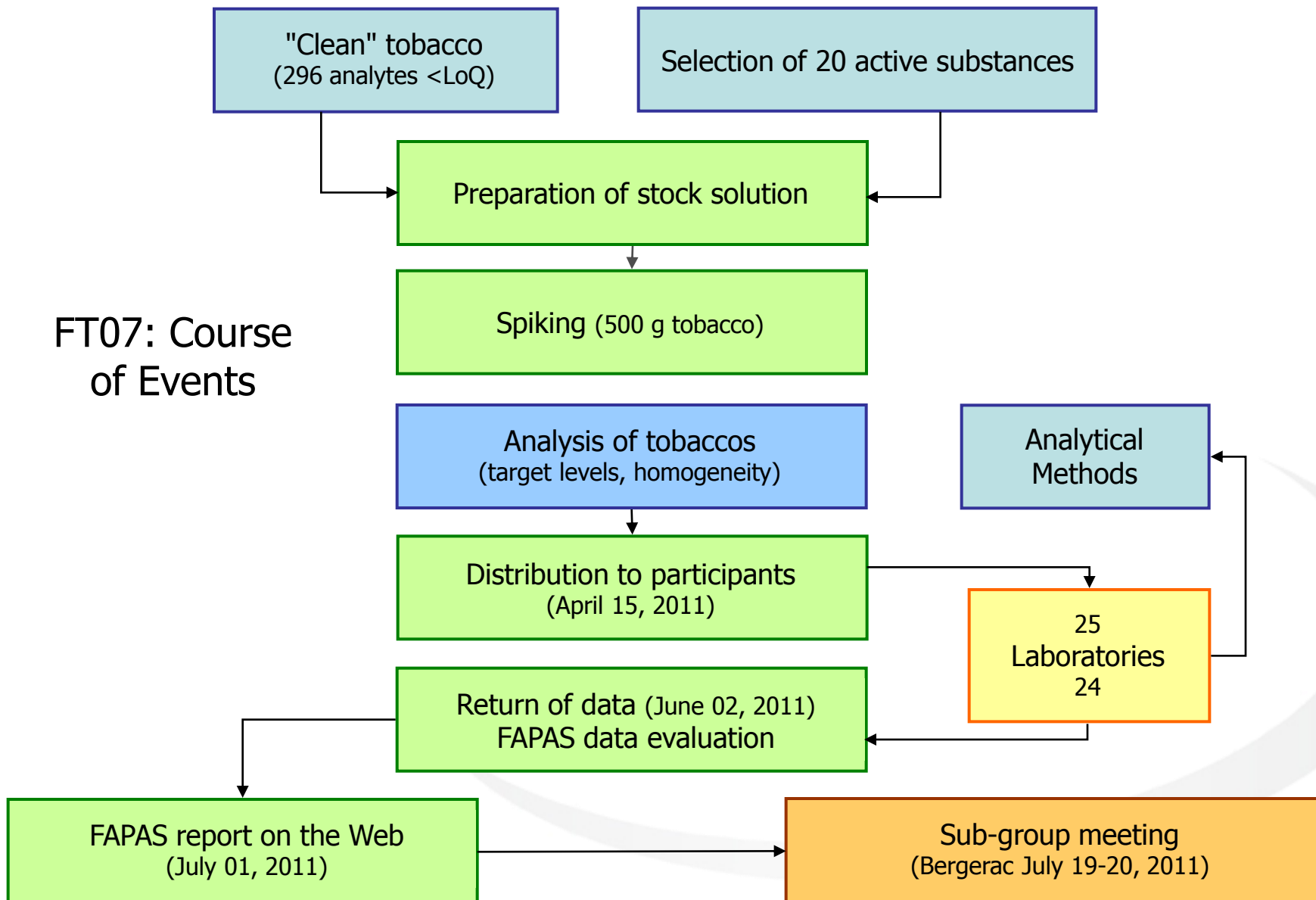
FT07: Agrochemical selection

Round 7: CPA List					
#	CPA	Spiking	Reported as	GRL	Type
		ppm		ppm	
1	2,4-D	0,20	2,4-D	0,20	Herbicide
2	Axoxystrobin	0,10	Axoxystrobin	n.a.	Fungicide
3	Benalaxyl	0,50	Benalaxyl	2,00	Fungicide
4	Captan	0,20	Captan	0,70	Fungicide
5	Chlorantraniliprole	5,00	Chlorantraniliprole	n.a.	Insecticide
6	Chlorpyrifos	0,40	Chlorpyrifos	0,50	Insecticide
7	Dicloran	0,80	Dicloran	1,00	Fungicide
8	Diflubenzuron	0,20	Diflubenzuron	0,10	Insecticide
9	Dimethomorph (Σ)	1,00	Σ of (E)-Dimethomorph and (Z)-Dimethomorph	2,00	Fungicide
10	Famoxadone	3,00	Famoxadone	5,00	Fungicide
11	Fenamidone	0,40	Fenamidone	n.a.	Fungicide
12	Iprobenfos	0,10	Iprobenfos	n.a.	Fungicide
13	Deltamethrin (Σ)	0,50	Σ of Deltamethrin + Tralomethrin	1,00	Insecticide
14	Flumetralin	2,50	Flumetralin	5,00	Growth Regulator
15	Indoxacarb (Σ)	2,00	Σ Indoxacarb (isomers S and R)	n.a.	Insecticide
16	Metalaxyl	0,50	Σ of all isomers including Metalaxyl-M / Mefenoxam	2,00	Fungicide
17	Methamidophos	1,00	Methamidophos	1,00	Insecticide
18	Pendimethalin	1,00	Pendimethalin	5,00	Herbicide
19	Triazophos	0,50	Triazophos	n.a.	Insecticide
20	Triflumuron	0,20	Triflumuron	n.a.	Insecticide

Objective 1: MRM Proficiency Testing



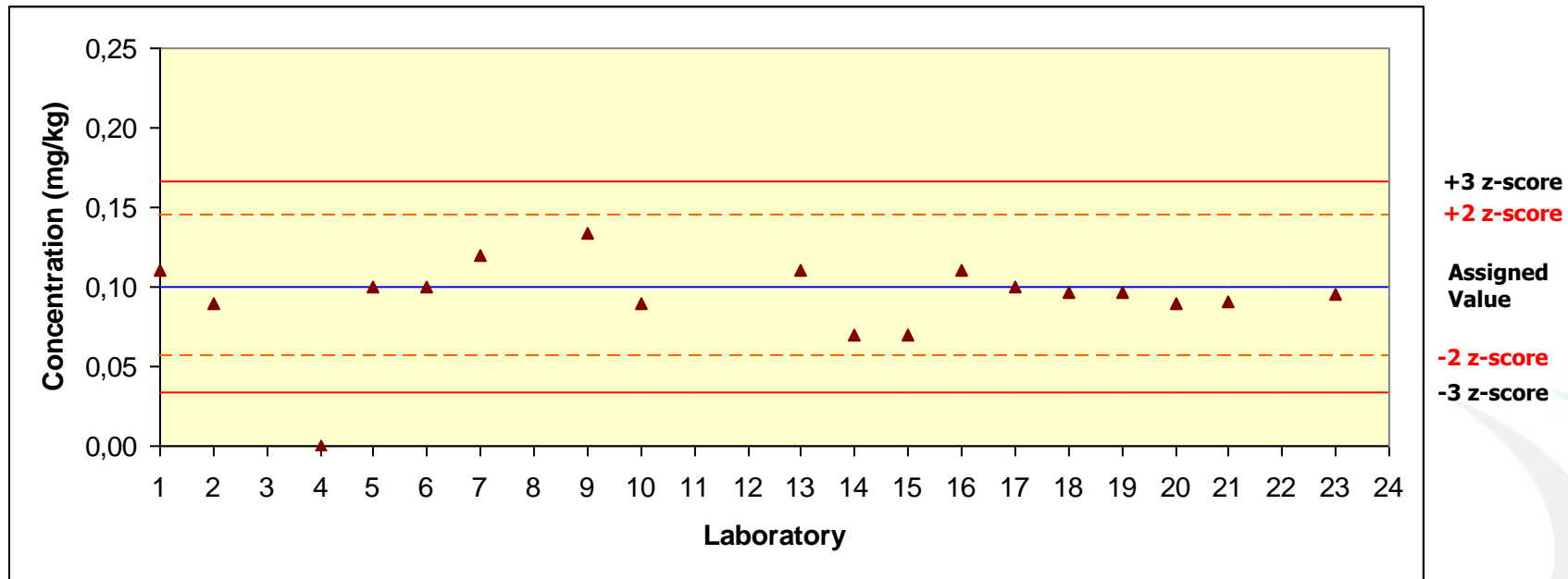
FT07: Course of Events



Objective 1: MRM Proficiency Testing



Azoxystrobin: laboratory results, z-score and assigned value

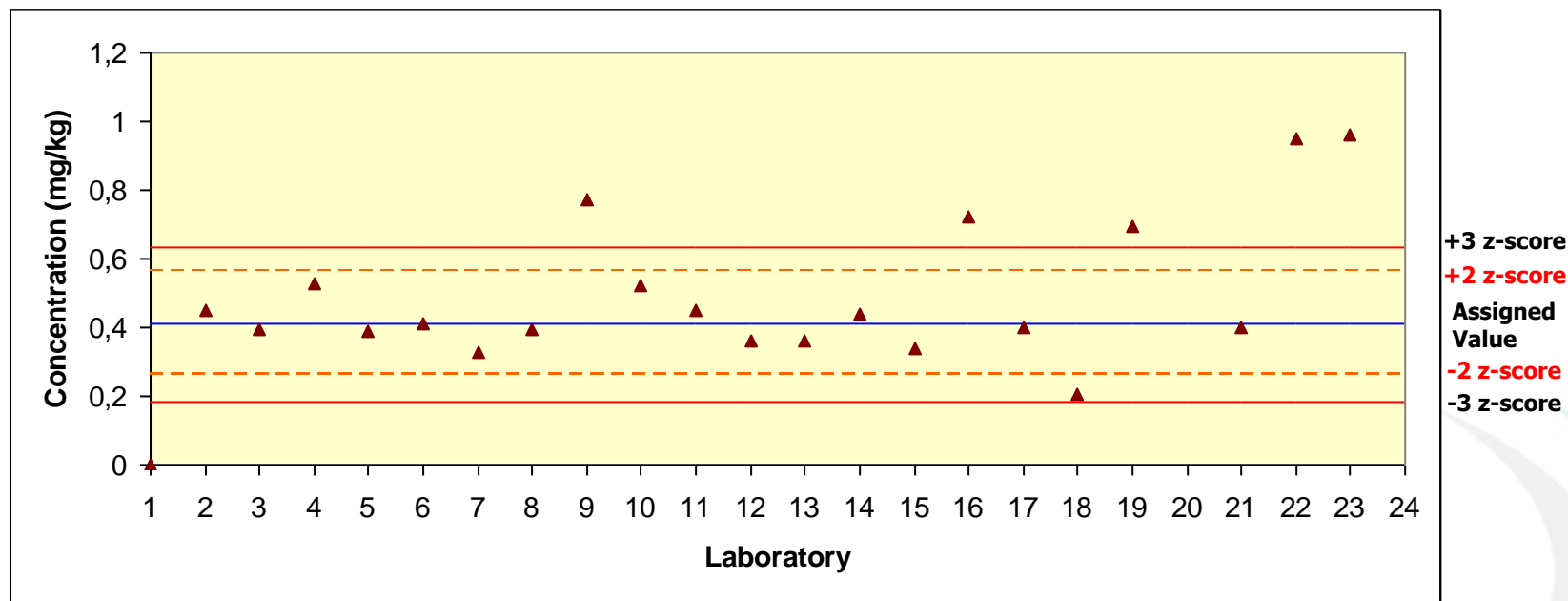


Azoxystrobin	Total laboratories	Total n° of scores	Scores %	N° of satisfactory scores	Satisfactory %
	24	17	71	17	100

Objective 1: MRM Proficiency Testing



Deltamethrin: laboratory results, z-score and assigned value



Deltamethrin	Total laboratories	Total n° of scores	Scores %	N° of satisfactory scores	Satisfactory %
	24	21	88	14	67

Objective 1: MRM Proficiency Testing



Round 7: z-scores satisfactory %

	2,4-D	Azoxystrobin	Benalaxyl	Captan	Chlorantraniliprole	Chlorpyrifos	Deltamethrin	Dicloran	Diflubenzuron	Dimethomorph	Fenoxadone	Fenamidone	Flumetralin	Indoxacarb	Iprobenfos	Metalaxyl	Methamidophos	Pendimethalin	Triazophos	Triflumuron	Total n° of score	N° of satis. scores	Satisfactory %	
1				no z-score			-5,5			2,2				-2,3			-3,4				19	17	89	
2																						18	17	94
3	no z-score						-2,1															3	1	33
4		no z-score																				11	10	91
5																						19	19	100
6												3,2										18	17	94
7	3,8		3,4						7,2		3,0	6,1		-4,7	3,0		2,9	9,7	2,7			19	8	42
8			5,6								3,1	-2,4		4,3				-2,3	2,9			12	6	50
9							2,5	4,9		-4,8		-7,4			2,2			-5,8		2,4	-4,9	18	10	56
10							3,1		4,5	-4,8										3,8		19	15	79
11							no z-score												no z-score			4	2	50
12	-4,8													-5,4					-2,6			5	2	40
13																						19	19	100
14	-3,5																					12	11	92
15																						14	14	100
16								4,1		-4,8		-7,4						-5,8			-4,9	18	13	72
17																						19	19	100
18								-2,8														19	18	95
19								3,8		-2,1					6,9	no z-score						19	15	79
20							-2,2		-5,8					-6,9			-2,2					14	10	71
21																						19	19	100
22							no z-score	7,2														2	0	0
23								7,3				4,9				-2,4		6,9				19	15	79
24								2,6														3	2	67
Total number of score	15	17	19		15	22	22	19	18	19	16	15	21	16	12	19	18	21	16	15				
Number of satisfactory scores	12	17	17		14	18	14	16	14	17	9	15	17	12	11	17	12	17	15	13				
Satisfactory %	80	100	89		93	82	64	84	78	89	56	100	81	75	92	89	67	81	94	87				

= satisfactory
 = unsatisfactory
 = not found / <LoQ
 = no tested for
underline = for information only

Objective 1: MRM Proficiency Testing



z-scores satisfactory % comparison between PTs

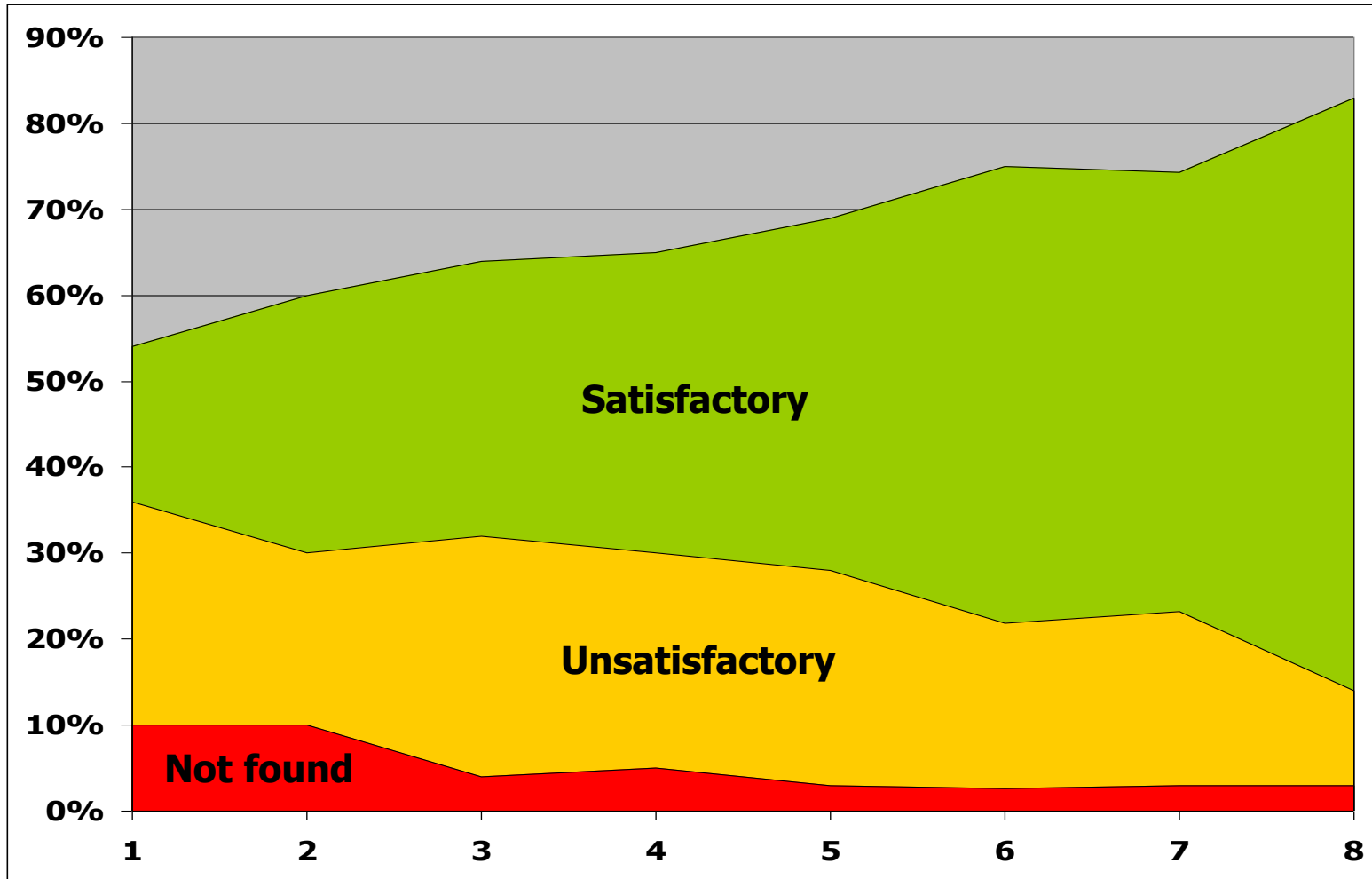
	2004	2005	2006	2007	2008	2009	2010	2011
	Pilot Run	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
Analytes not tested for	42%	16%	15%	23%	33%	27%	17%	25%
Analytes within battery	58%	84%	85%	77%	67%	73%	83%	75%
Results satisfactory	54%	60%	64%	65%	69%	75%	74%	83%
Results unsatisfactory	36%	30%	32%	30%	28%	22%	23%	14%
Analytes not found	10%	10%	4%	5%	3%	3%	3%	3%

Results satisfactory	Pilot Run	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
Aldicarb	-	-	-	59%	-	-	79%	-
Butralin	-	-	-	78%	-	-	70%	-
Carbaryl	45%	-	-	-	80%	-	83%	-
Carbendazim	-	-	-	67%	-	76%	52%	-
Chlorothalonil	-	-	44%	43%	-	no z-score	-	-
Chlorpyrifos (-ethyl)	-	83%	-	-	-	76%	-	82%
Chlorthal-dimethyl	50%	-	-	-	-	75%	-	-
Cypermethrin	79%	-	71%	-	-	68%	73%	-
Benalaxyl	-	64%	-	-	-	-	-	89%
Deltamethrin	-	44%	59%	-	-	-	60%	64%
Dimethomorph	-	-	-	-	60%	-	-	89%
Endosulfan (Σ)	-	59%	67%	-	-	68%	-	-
Famoxadone	-	-	-	-	-	no z-score	-	56%
Fenamiphos	-	-	-	-	79%	-	90%	-
Flumetralin	-	-	61%	-	-	-	71%	81%
Heptachlor	81%	77%	-	-	-	-	-	-
Imidacloprid	-	54%	64%	-	-	-	-	-
Indoxacarb	-	-	-	-	-	-	83%	75%
Iprodione	-	-	-	-	58%	85%	-	-
Metalaxyl	33%	-	63%	-	-	-	-	89%
Methamidophos	8%	25%	44%	48%	-	55%	no z-score	67%
Permethrin	-	-	-	81%	-	-	71%	-
Pendimethalin	-	87%	76%	-	-	-	62%	81%
Profenophos	54%	-	76%	-	-	-	70%	-
Trifluralin	62%	-	-	87%	-	-	90%	-

Objective 1: MRM Proficiency Testing



z-scores satisfactory % comparison between PTs



Objective 2: Joint Experiment Test Study



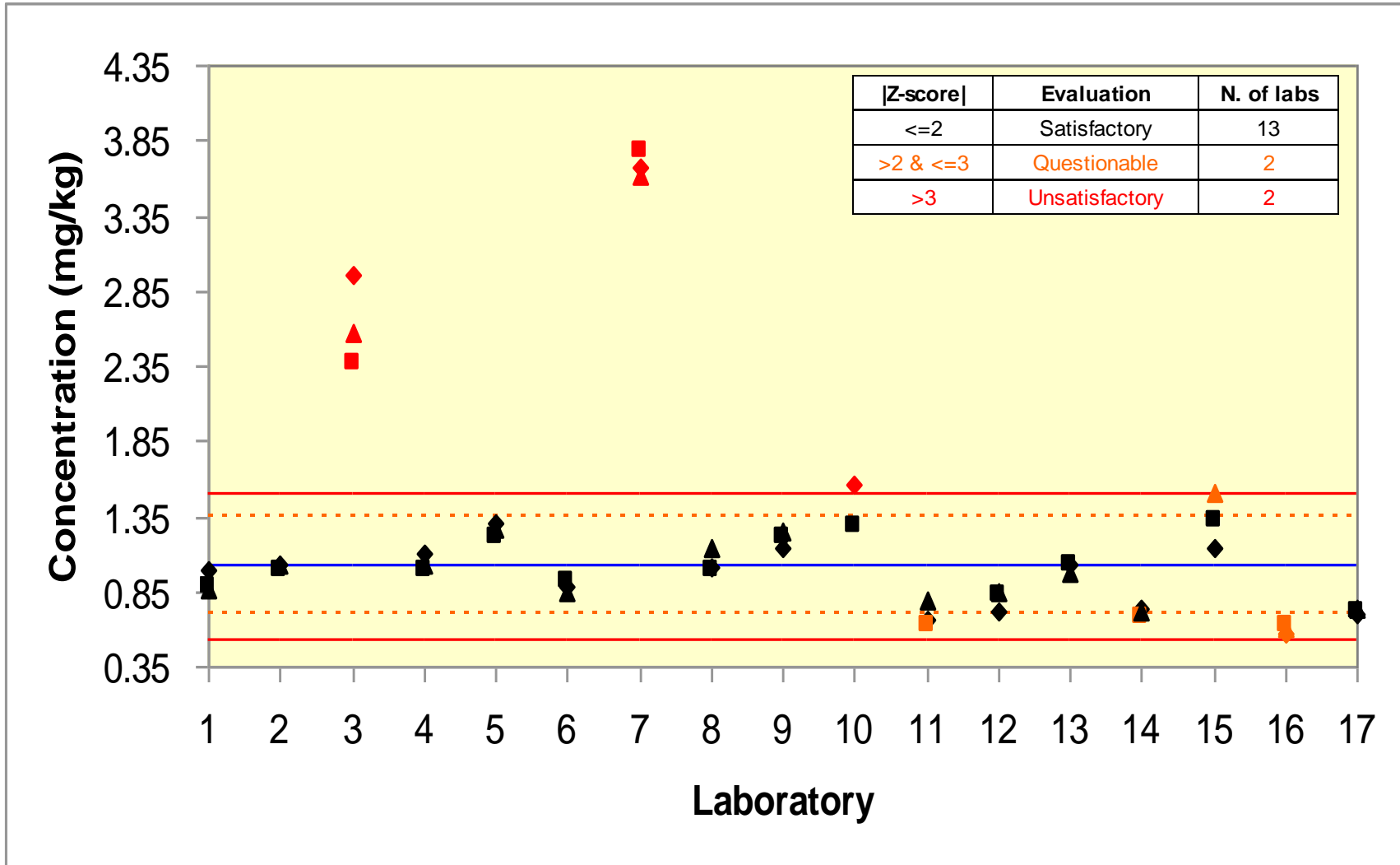
Joint Experiment Test Study

- ❑ Objective: To identify analytical issues for specific CPAs arising from the proficiency test
- ❑ Performed: [Cyfluthrin](#) (coordinator **Masahiro Miyoshi**, JT LTRC Oyama)
 - 17 participant laboratories
 - Test material:
 - ❑ Sample 1: naturally incurred tobacco (Turkish Oriental crop 2008)
 - ❑ Sample 2: artificially spiked tobacco
 - ❑ Sample 3: blank tobacco for recovery and/or matrix-matched calibration
 - ❑ Homogeneity test sample 1 and 2
 - Test procedure:
 - ❑ Each sample was analyzed in triplicate
 - ❑ Laboratories were free to choose the analytical method
 - ❑ Two recoveries (fortification level 0.50 mg/kg) were measured

Objective 2: Joint Experiment Test Study



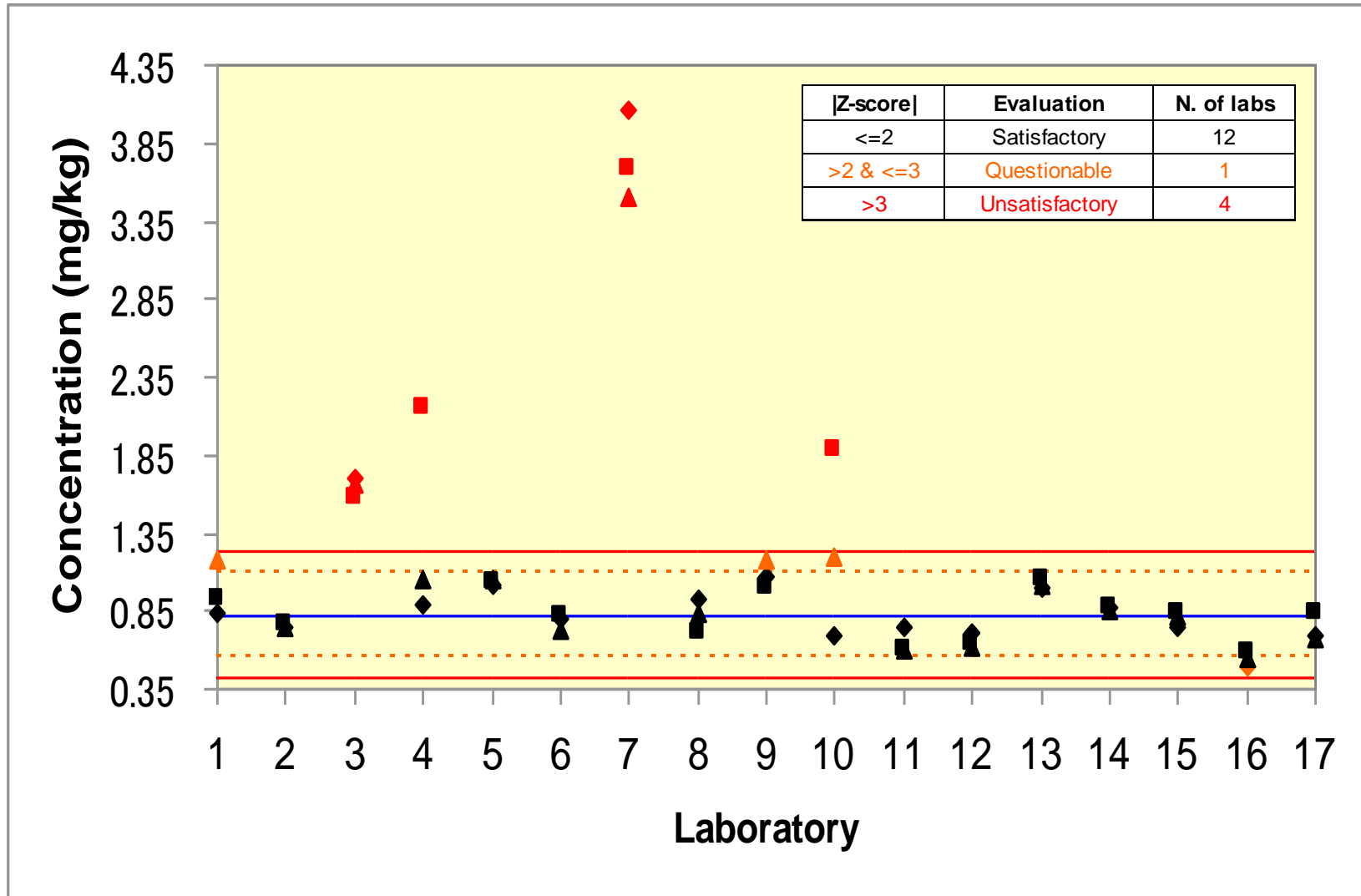
Sample 1 – naturally incurred



Objective 2: Joint Experiment Test Study



Sample 2 – artificially spiked



Objective 2: Joint Experiment Test Study



Sample 1 & Sample 2

Lab number	Z-score	
	Sample 1	Sample 2
1	-0.6	1.2
2	0.0	-0.5
3	9.9	6.1
4	0.1	4.1
5	1.5	1.6
6	-0.9	-0.3
7	16.5	21.7
8	0.2	0.0
9	1.0	1.9
10	2.5	3.3
11	-2.0	-1.3
12	-1.4	-1.2
13	0.0	1.5
14	-1.9	0.4
15	1.9	-0.1
16	-2.6	-2.1
17	-1.9	-0.7

Except Lab 4, each laboratory obtained almost the same Z-score for both samples, regardless of the type of samples, i.e. incurred or spiked.

Objective 2: Joint Experiment Test Study



Degradation Study: coordinator **Dr. Thomas Anspach** - Eurofins Dr. Specht

#	CPA	Spiking	Reported as	GRL	Notes
		ppm		ppm	
1	Aldicarb (Σ)	0,40	Σ of Aldicarb + Aldicarb sulfoxide + Aldicarb sulfone	0,50	
2	Carbendazim (Σ)	3,00	Σ of Benomyl + Carbendazim + Thiophanate-methyl	2,00	Degradation study
3	Butralin	2,00	Butralin	5,00	Degradation study
4	Carbaryl	0,50	Carbaryl	0,50	
5	Cyfluthrin (Σ)	0,50	Σ Cyfluthrin (all isomers)	0,50	Degradation study
6	Cypermethrin (Σ)	1,50	Σ Cypermethrin (all isomers)	1,00	Degradation study
7	Deltamethrin (Σ)	1,00	Σ of Deltamethrin + Tralomethrin	1,00	
8	Difenconazole	0,50	Difenconazole	na	
9	Fenamiphos (Σ)	0,30	Σ of Fenamiphos + Fenamiphos sulfoxide + Fenamiphos sulfone	0,50	
10	Flumetralin	6,00	Flumetralin	5,00	Degradation study
11	Indoxacarb (Σ)	1,00	Σ Indoxacarb (isomers S and R)	15,00	
12	Methamidophos	2,00	Methamidophos	1,00	
13	Pendimethalin	3,00	Pendimethalin	5,00	Degradation study
14	Permethrin (Σ)	0,60	Σ Permethrin (all isomers)	0,50	Degradation study
15	Profenofos	0,20	Profenofos	0,10	
16	Trifluralin	0,20	Trifluralin	0,10	Degradation study

- ❑ Test material: FAPAS Round 6 samples → 8 CPAs identified for the degradation study
- ❑ The CPAs for the degradation study have been communicated to the laboratories at the end of the PT
- ❑ Some laboratory have additionally tested: **Aldicarb, Aldicarb sulfoxide, Carbaryl, Deltamethrin, Indoxacarb, Fenamiphos, Fenamiphos sulfoxide, Methamidophos, Profenofos**
- ❑ 7 participant laboratories: **GLS, Oekolab, Microbac, LANaRT, Eurofins Dr. Specht, Eurofins Sweden, JT LTRC**

Objective 2: Joint Experiment Test Study

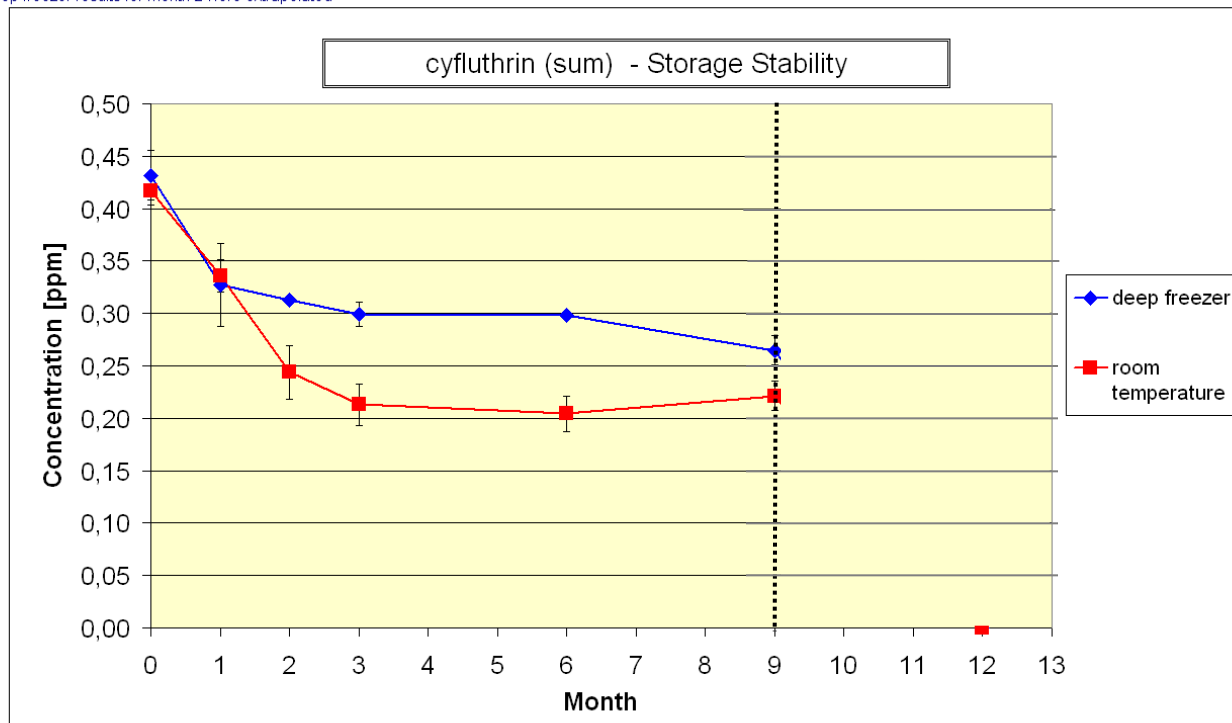


Degradation Study

cyfluthrin (sum)

date of analysis	deep freezer					room temperature					fortification level [ppm]	fortification recovery [%]
	replicate 1 [ppm]	replicate 2 [ppm]	replicate 3 [ppm]	mean [ppm]	SD [ppm]	replicate 1 [ppm]	replicate 2 [ppm]	replicate 3 [ppm]	mean [ppm]	SD [ppm]		
Month 0	0,429	0,409	0,457	0,432	0,024	0,418	0,430	0,403	0,417	0,014		
Month 1	0,289	0,325	0,368	0,327	0,039	0,321	0,352	0,335	0,336	0,016		
Month 2	0,313	0,313	0,313	0,313	0,000	0,216	0,267	0,248	0,244	0,026		
Month 3	0,296	0,290	0,312	0,299	0,011	0,200	0,236	0,204	0,213	0,020		
Month 6	0,299	0,301	0,296	0,299	0,003	0,186	0,207	0,219	0,204	0,017		
Month 9	0,250	0,267	0,277	0,265	0,014	0,206	0,223	0,234	0,221	0,014		
Month 12				#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		

Note: deep freezer results for Month 2 were extrapolated

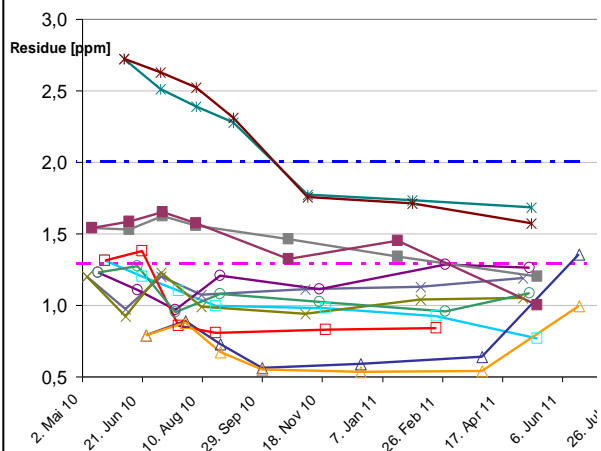


Objective 2: Joint Experiment Test Study



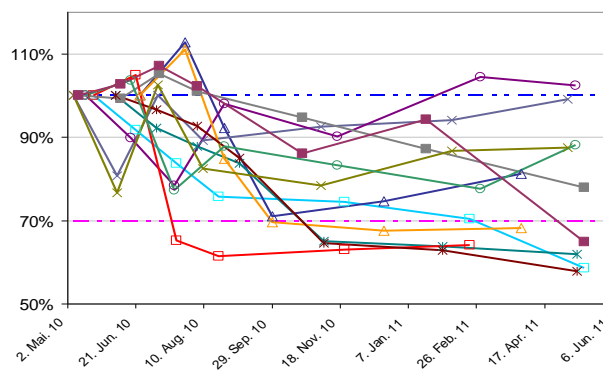
Degradation Study: graphical set-up of results

individual absolute mg/kg results



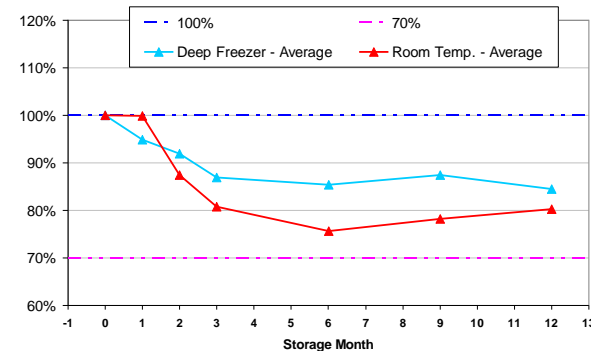
The mg/kg results of each lab are plotted versus the concrete date of month (no correction for recovery was made)

individual relative % results



Day 0 of each lab was set to 100% and percentage of the following monthly results was calculated in regards to day 0

average degradation curve



Mean percentage value for each month interval for all lab results was calculated and plotted versus unified month x-scale

Objective 2: Joint Experiment Test Study



Assessment of degradation studies

ec.europa.eu/food/plant/protection/resources/app-h.pdf

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7032/VI/95 rev.5
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Directorate General for Agriculture

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APPENDIX H

STORAGE STABILITY OF RESIDUE SAMPLES

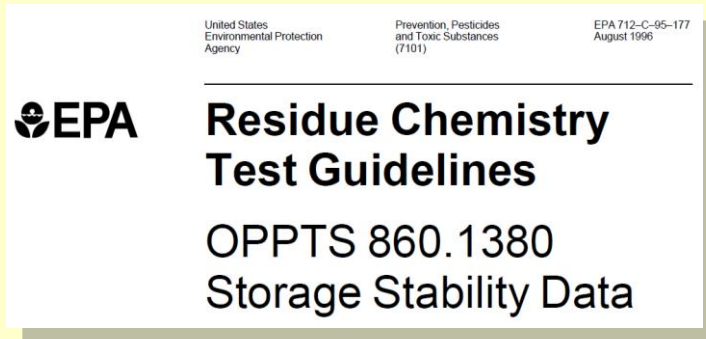
Where the degradation during storage is significant (more than 30%) it may be necessary to use a shorter sample storage period prior to analysis.

Objective 2: Joint Experiment Test Study



Assessment of degradation studies

www.epa.gov/ocspp/pubs/frs/publications/Test_Guidelines/series860.htm



(8) **Use of storage stability results.** (i) If a storage stability study shows limited decline of residues during the storage period observed for the corresponding magnitude-of-the-residue study, correction factors will generally be used to determine the residue levels that were present at the time of sample collection in the study. However, if extensive dissipation of residues has occurred during storage, the study may need to be repeated with samples analyzed closer to their time of collection. As a rule of thumb, correction factors will be applied to losses in storage up to 30 percent. Beyond that point, the Agency will consider corrections on a case-by-case basis taking into account factors such as the absolute (parts per million) and relative (percent of TTR) residue levels of the component that is unstable in storage.

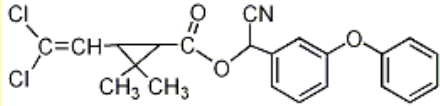
(ii) The degree of loss will normally be adjusted or corrected for analytical method recoveries before applying the 30 percent rule of thumb. In other words, the apparent residue level of an analyte after storage should be divided by the analytical method recoveries obtained for freshly fortified samples analyzed at the same time. For example, a storage stability sample was originally prepared by spiking at 1.0 ppm (level confirmed by zero-day analysis after correcting for method recovery of 75 percent on a freshly fortified sample). After a given period of storage, a portion of the sample is analyzed and found to contain only 0.63 ppm (an apparent loss of 37 percent). If the method recoveries for freshly fortified samples analyzed at the same time are 70 percent, the corrected residue level in the stored sample is $0.63 \text{ ppm} / 0.70 = 0.90 \text{ ppm}$. Thus, the corrected degree of loss in storage is 10 percent (or corrected recovery of 90 percent for the stored sample).

Objective 2: Joint Experiment Test Study



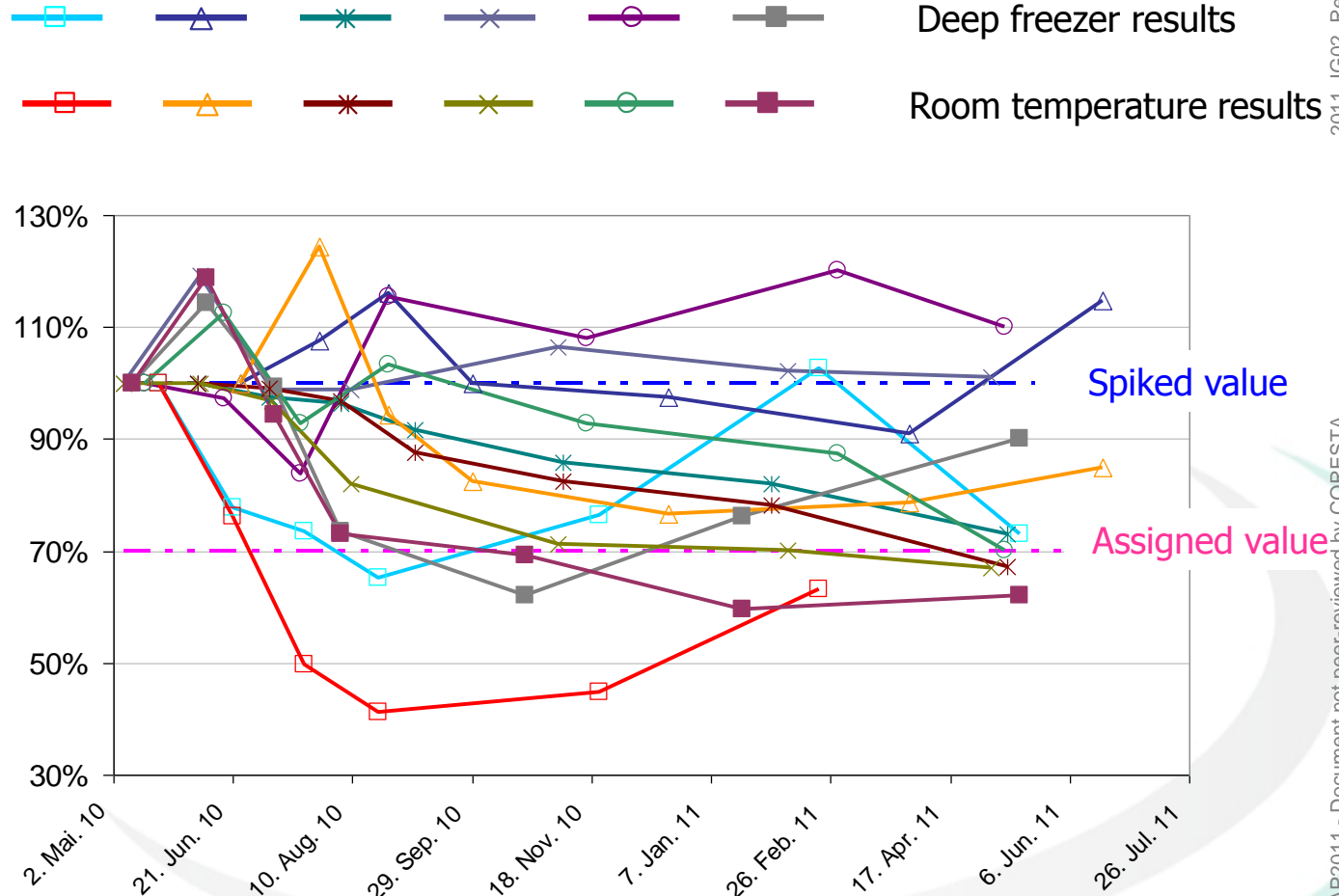
Cypermethrin – individual absolute results [ppm]

pyrethroid



Comprises a mixture of cis- and trans-isomers

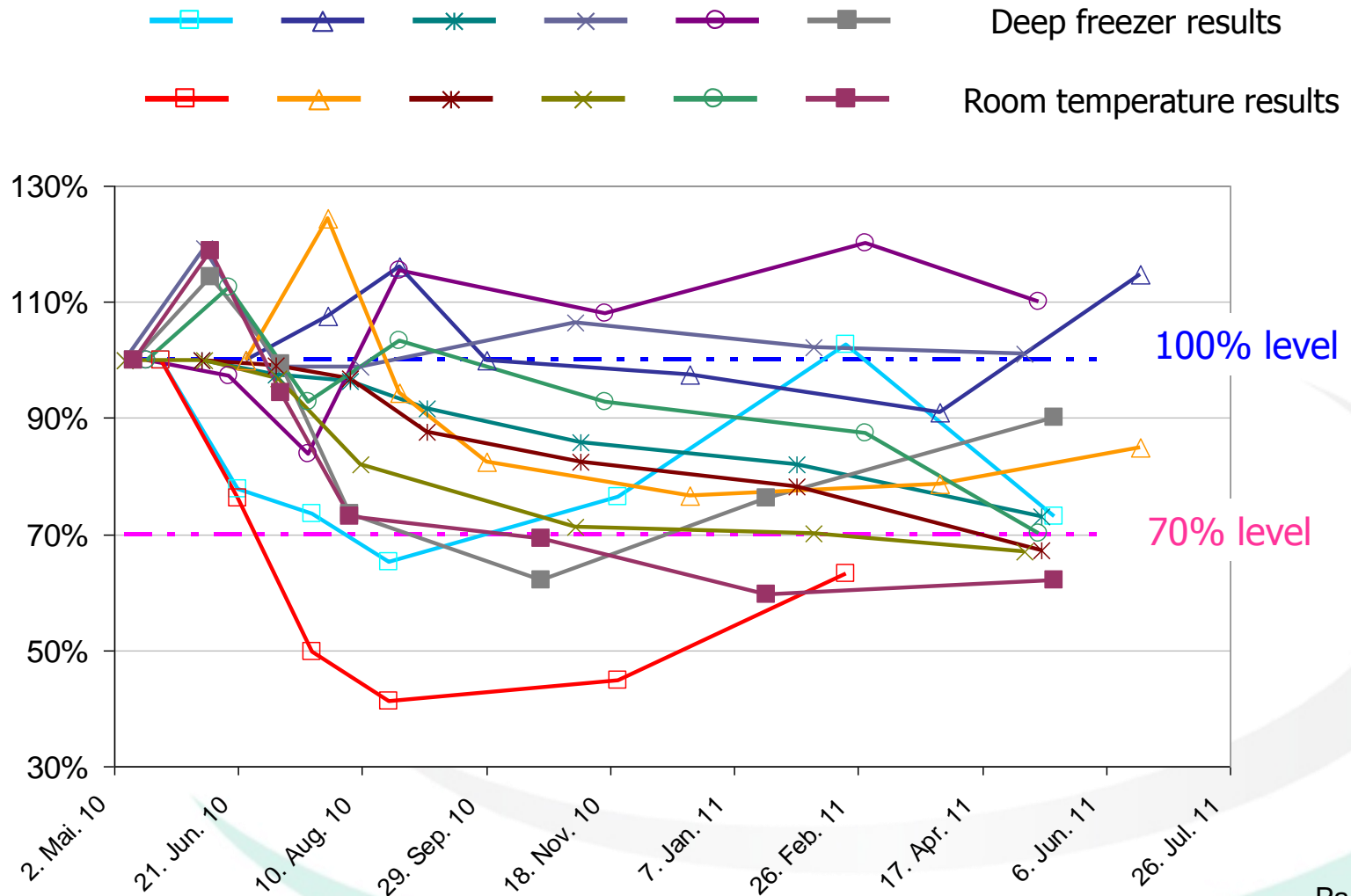
On the plant:
No information.



Objective 2: Joint Experiment Test Study



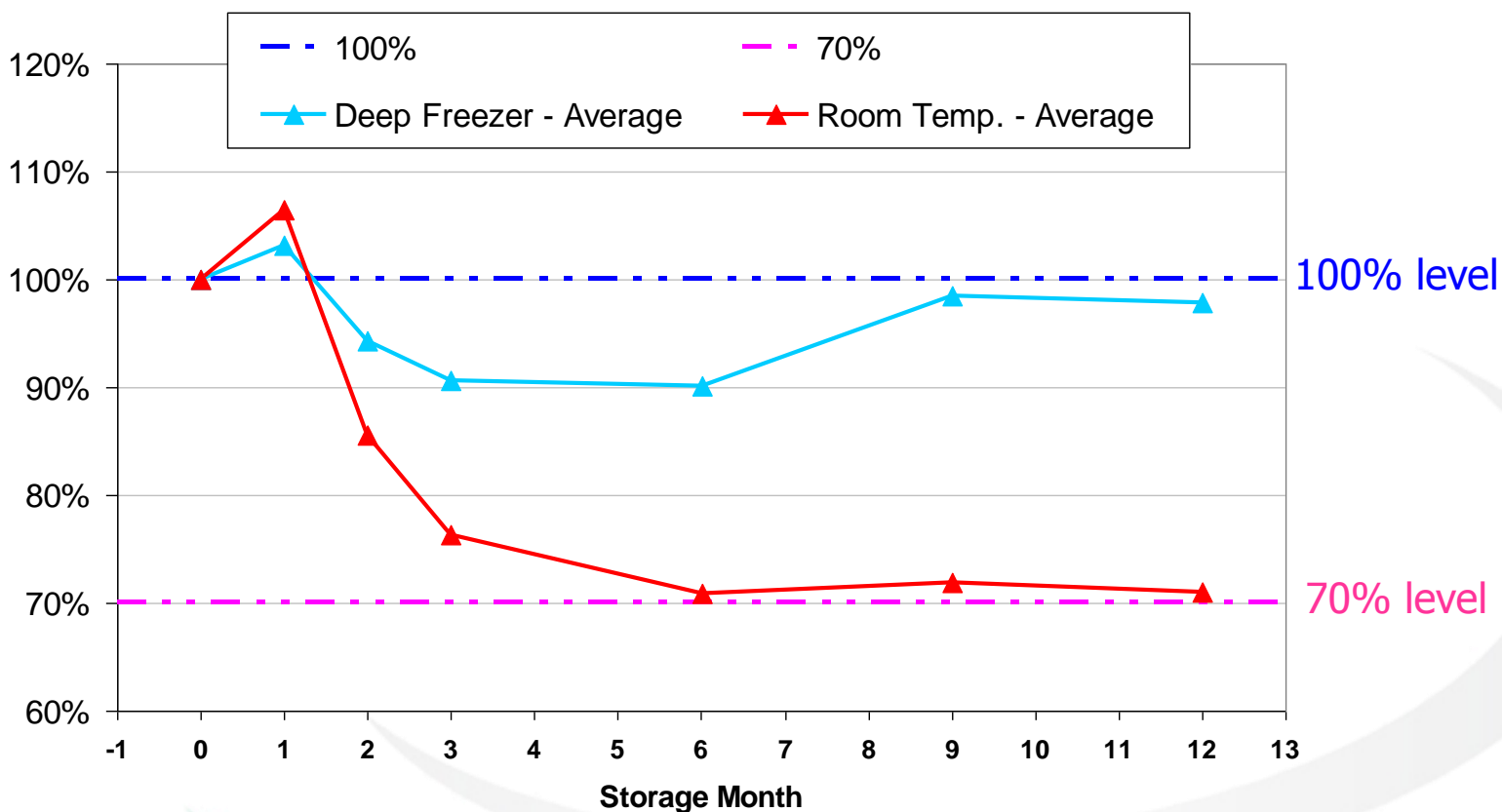
Cypermethrin – individual relative results [%]



Objective 2: Joint Experiment Test Study



Cypermethrin – average degradation curve





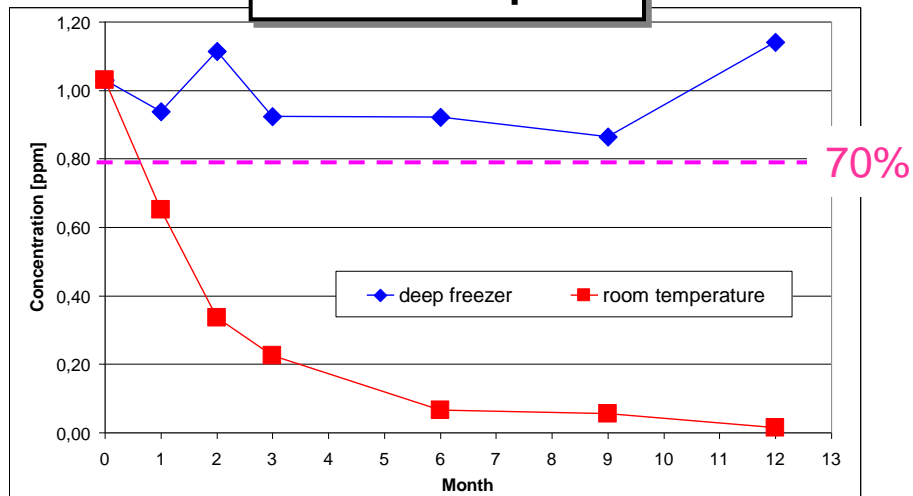
Degradation Study: Conclusion

- ❑ No significant degradation losses for any of the investigated agrochemicals were found
- ❑ Only the pyrethroids **cyfluthrin** and **cypermethrin** showed degradation curves for room temperature storage with about 30% losses over the time
- ❑ Some laboratories have conducted the study with the additional agrochemicals in the spiked sample from the proficiency test "Round 6":
Aldicarb, Aldicarb sulfoxide, Carbaryl, Deltamethrin, Indoxacarb, Fenamiphos, Fenamiphos sulfoxide, Methamidophos, Profenofos

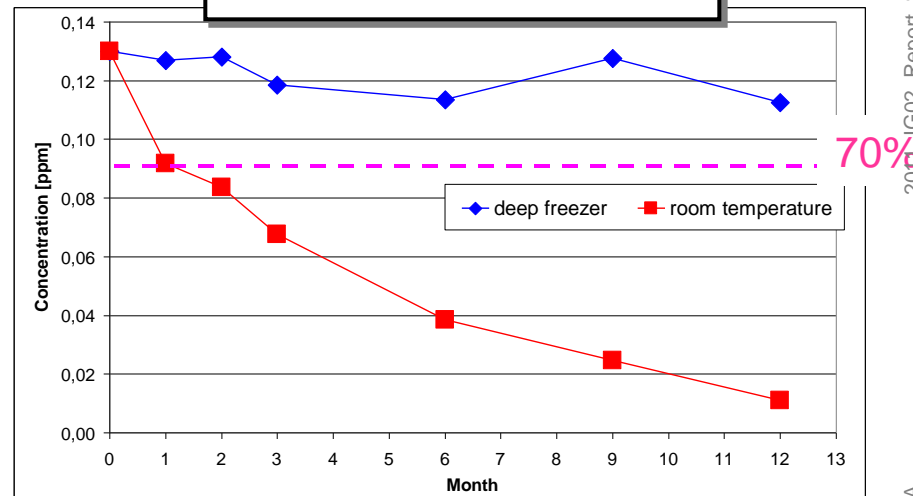
Additional degradation data



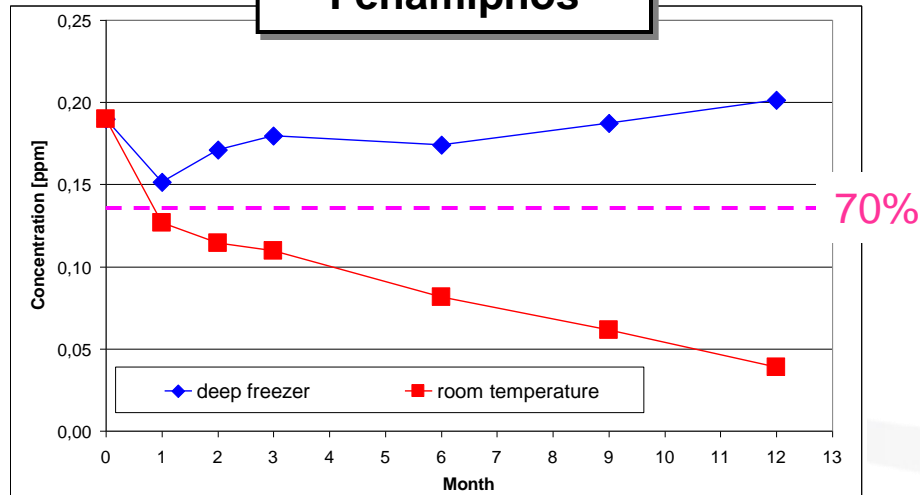
Methamidophos



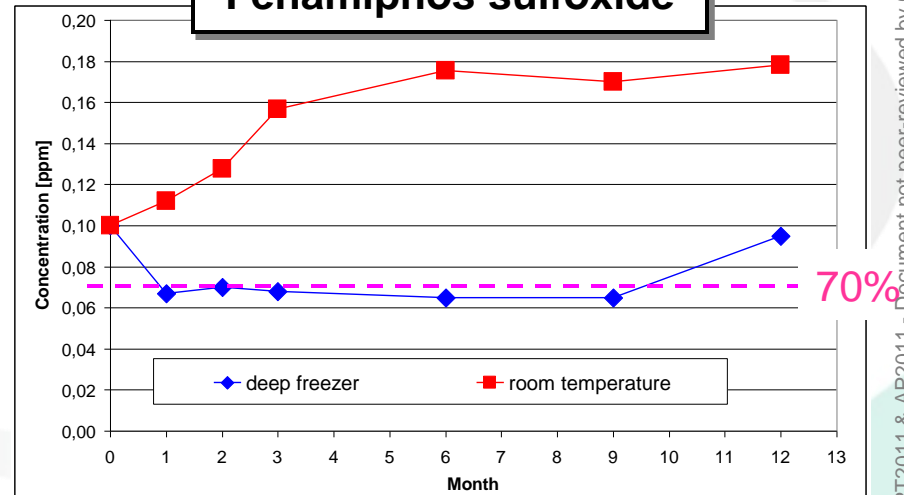
Profenofos



Fenamiphos



Fenamiphos sulfoxide



Objective 3: Technical Notes



Technical Note: Maleic Hidrazide (Fraser Williamson)

Agrochemical Analysis Technical Note TN 4001

Maleic Hydrazide

Plant growth regulator

Background information

It is important to note that MH, as the free acid, is not used as an agrochemical due to its low water solubility. It is instead formulated as the potassium salt, MH-K, (CAS No. 1062-13-0), which possesses a much higher water solubility (500 versus 81 g/L) allowing it to penetrate the target plant more effectively.

The original commercial formulation for use on tobacco was MH-K 50% wettable powder (WP). Other crop uses (maize, cereals, etc.) consist of the dihydrochloride salt of maleic hydrazide (MH-2HCl). The WP option is for formulation containing the potassium salt of maleic hydrazide (MH-K).

An arbuscular mycorrhizal fungus, *Rhizophagus irregularis*, has been shown to facilitate the uptake of MH by tobacco plants, which in turn allows for increased plant growth and yield. This is in part due to the fact that MH is not taken up by the tobacco plant as readily as it is by the mycorrhizal fungus. The use of MH is also limited by its relatively short half-life in tobacco, which can be overcome by the use of a more persistent formulation.

Early investigations into the properties of MH demonstrated that it was a weakly active agent (F2, F3, F4). However, further work conducted with the potassium salt of MH, MH-K, demonstrated that it was a much more potent herbicide, especially when used as a potassium salt of maleic hydrazide (MH-K). Current formulations are based on a 1:1 ratio of herbicide:potassium with an apparent effect (herbicide:potassium or potassium associated) with an 80% yield.

Production of MH potassium salt, Cotnam Corporation (Herb 500), DuPont Chemical Co. (Ductone 400) and H. W. Wilson (Ductone 400) are registered trademarks.

The CAS number for MH is currently not an RW (mg/kg) (S).

Properties:

Formula:	C ₅ H ₄ N ₂ O ₂
Molar Mass:	106.10
CAS No.:	1062-13-0 (1062-13-0)
Form:	White crystalline solid
Solubility:	Water (50 g/L at 25°C); 20°C (20 g/L)
Melting Point:	165°C (lit.)
Stability:	Stable in solution; unstable in acid; not stable in alkaline and basic solutions; soluble in hydrochloric acid
pKa:	5.62
ref:	SRM 495C

Fig 1. Maleic hydrazide structures:

Structure I: Maleic hydrazide
Structure II: Maleic hydrazide
Structure III: Maleic hydrazide

RP/EC name: 1,1'-diethylhydrazide 3,4-dioxo (E)-butenediyl potassium salt (E)-butenediyl potassium salt

Maleic hydrazide exhibits lowered biotoxicity, with protein synthesis occurring faster in solution (1). Experimental studies indicate the mechanisms of the recently discovered herbicide (2) are both the acid form and its potassium salt. The effect is more active against (3) while the dihydrochloride salt (4) generally not favored and of minor importance (5).

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Sample Preparation (Extraction and Clean-up)

After application, maleic hydrazide is absorbed through the tobacco plant where it is converted, or "fixed," MH is found in leaves but will not wash (Figures 1) or be metabolized with glucose to form gluconic conjugates. MH on C₁₈ (glucoside) (Figure 2) (22, 23, 24). Bound and conjugated forms of MH are not thought to participate in phytochemical responses and thus are not considered in this document (25).

Levels of free MH decrease after harvesting, curing, and storage, indicating a gradual conversion to one of the bound forms.

Metals have been used to extract maleic hydrazide and its glucoside from plant material. However, in order for the MH glucoside conjugate to be quantified as MH it was necessary for it to be hydrolyzed with the strongest glucanase prior to analysis (21).

Herbicide conjugates such as free enantiomeric salt and its glucoside conjugate. While the glucoside conjugates can be extracted they will not contribute to the MH measurement the glucoside group is shared. Although glucanase treatment will hydrolyze MH-GP-glucoside it has not been in MH-GP-glucoside (26).

In order to fully assess MH, including that bound to cell walls, aggressive extraction methods are required. Both organic and acidic conditions have been shown to work well and also have the added benefit of hydrolyzing the glucoside conjugates in the process.

Figure 2. Chemical of MH:

Figure 2 shows two chemical structures: MH-GP-glucoside and MH-GP-glucoside. The structures are identical, showing a maleic hydrazide core with a glucose unit attached to the nitrogen atom.

Modes of Analysis

Due to its chemical structure and properties, MH is capable of being analyzed by a range of different analytical techniques.

The earliest procedures involve the hydrolysis of MH to maleic hydrazide by acid. The hydrolysis is induced by acid digestion and subsequent colorimetry or as an assay to the addition of a colorimetric reagent. Such colorimetric procedures have been approved by SOI (26) and AOAC (27) as reference and official methods, respectively. The same colorimetric approach was also used to detect MH in tobacco (28). The development of the hydrolysis method in tobacco (28) has also been used for the detection of MH residues in tobacco (28). The colorimetric method, often SOI at AOAC or other variants of this base, has not been widely used for MH analysis in tobacco (28). The colorimetric method, often SOI at AOAC or other variants of this base, has not been widely used for MH analysis in tobacco (28). The colorimetric method, often SOI at AOAC or other variants of this base, has not been widely used for MH analysis in tobacco (28).

Size and liquid chromatography procedures have also been widely reported. As MH is generally in malesic salt form, it is not expected to be ionizable or to be detected in order to be analyzed by gas chromatography (GC). Numerous MH derivatizations have been reported including methyl and diethyl ether salts, which allow for a wide range of different detection techniques to be employed such as NDS, IR and GC (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100).

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Analysis (Chromatography and quantitation)

Typical variables of the chromatogram that can be expected when analyzing MH by GC-MS and HPLC are described in Figure 3a and 3b, respectively.

Figure 3a. Chromatogram of a Virginia tobacco extract containing approximately 200 ppm MH (10').

Figure 3b. Liquid chromatography (UV detection) of a Virginia tobacco sample containing approximately 70 ppm MH (10').

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Sections:

- Background information
- Modes of analysis
- Proprieties
- Analysis (Chromatography and quantitation)
- Sample preparation (extraction and clean-up)
- References

Additional Technical Notes: Dithiocarbamates, Acid herbicides, Dinitroanilines, Pyrethroides, Methamidophos

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Bergerac - France July 19th-20th, 2011





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Thank you

