Pesticide Residue and Analytical issues on bean products

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Outline of Topics

- Pesticide management in bean crops
- Pesticide maximum residue limits (MRLs)
- Analytical issues on bean products
- Recommendation and Discussion

1. Pesticides management in Bean Crops

- Current Situation
- MRL setting: crop groups and extrapolations
- Minor use / specialty crop
- Other Technical requirements

Current Situation of Pesticides management in Bean Crops

- Use herbicides, plant growth regulators , fungicides and other chemicals when planting or processing bean crops. Regulated or not?
- Use pesticides scientifically and protect food safety.
- To establish rapid, sensitive, rugged residue determination methods for monitoring and/or for risk dietary assessment purposes.

1.2 crop groups and extrapolations in MRL setting

Codex Crop Group	US Crop Group/ Subgroup	US Representative Commodity (for group or subgroup)
VP bean vegetables	6 bean Vegetables (Succulent or Dried) 6A Edible-podded bean 6B Succulent shelled pea and bean 6C Dried shelled pea and bean (except soybean)	Bean (one succulent and one dried) Pea (one succulent and one dried) Soybean (dry) Edible-podded bean Edible-podded pea → snap bean, wax bean, Chinese long bean, snow pea, sugar snap pea, pigeon pea, Soybean (immature seed), sword bean, etc Shelled succulent bean,garden pea → lima bean, broad bean (succulent), cowpea, pea (garden), pigeon pea, etc dried bean, dried pea → dried grain lupin, sweet lupin, white lupin, field bean, kidney bean, lima bean (dried), navy bean, pinto bean, cowpea, chickpea, lentil, pea (dried), pigeon pea, etc
VD Pulses	See above 6C	See above 6C

EU Groups of Crops	EU Representative Commodity and Extrapolation[2]	Australia Commodity Crops Groupings	Australia Possible Extrapolation From…	Australia Possible Extrapolation To…	Japan Crop Group3	Japan Representative Commodity and Extrapolation
2. Vegetables (vi) bean vegetables (fresh) Beans, green with pods Peas, green without pod	Beans, green with pods ↔ Peas with pods None	Beans (green) Peas (green)	Beans (green) + Peas (green)	Whole group	bean Vegetables (Succulent seeds and/or immature pods): Soy bean (immature seeds) Garden pea (young pods and immature seeds) Common bean (pods and Immature seeds)	Soy bean, garden pea and common Bean → whole group
3. Pulses, dry Beans, dry (including Broad beans)	Beans (dry) and/or peas (dry) →	Peas Beans Chickpea Lentils	Field peas (dry) + faba beans (dry) + lupins Or	Whole group	Pulses (Dried): Soybean (dry) Groundnut	Soybean (dry), groundnut and one other species →whole
Peas, dry (including chick peas)	Whole group	Lupin Soybean	Field peas (dry) + chickpeas + lupins Or Field peas (dry) + navy beans + lupins			group

1.3 Minor use/Specialty Crop

- “Minor use" means use of a plant protection product in a particular Member State on plants or plant products which are :

a. Not widely grown in that Member State, or

b. Widely grown to meet an exceptional plant protection need;

- Can avoid some of the challenges of comparative assessments, thus accelerate MRL setting economically

1.4 Other Technical requirements

- Processing industry standards has to be perfect;
- Fewer varieties of pesticides registered for use,
- Lack of basic data for risk assessment in storage bean products;
- Residues and safety evaluation in processed food products such as bean sprouts, starch vermicelli, bean paste, etc.

Process factors

- Quantify levels of residues in processed commodities
- Provide the distribution of residues (active ingredient, and/or metabolites, degradation products)
- Estimate processing factors (the ratio of residue levels in processed commodities to those in the raw agricultural commodity)

$$Pf = \frac{\text{residue level in processed commodity}}{\text{residue level in the RAC or commodity to be processed}}$$

Processing procedure	Explanations	Examples of typical crop/RAC	Explanations	Domestic or Industrial
Preparation of oil	Pressing or extraction including meal or press cake used as animal feed	Rapeseed (canola) Olives Maize (Corn)	1)Solvent extraction (crushing): Olive → None Cottonseed ↔ soybean→ rapeseed (canola)↔ other oilseeds 2)Cold press: Olive → None Cottonseed ↔ soybean→ rapeseed (canola)↔ other oilseeds	I
Distribution on milling	Including bran and gluten used as animal feed. Other grain fractions used as feeds.	Wheat Rice Maize (corn)	Wheat → all small grains except rice (oats, barley, triticale, rye) Rice →wild rice Maize (corn, dry milling)→ sorghum	I
Cooking vegetables, pulses and grains in water including steaming)		Carrots Beans/peas (dry) Beans/peas (succulent) Potatoes Spinach Rice [polished (white) or husked(brown)]	Spinach → leafy vegetables, brassica vegetables (<20 minutes) Potatoes → root, tuber, bulb vegetables, fresh beans (>20 minutes) Rice →all grains	D
Preparation of canned vegetables		Common (green or snap) bean Corn (sweet) Pea (garden, succulent) Potato Spinach Beet (garden, table)	Common bean, corn, pea, or spinach →all vegetables Potato → sweet pot ato	D/I

Enrichment during processing

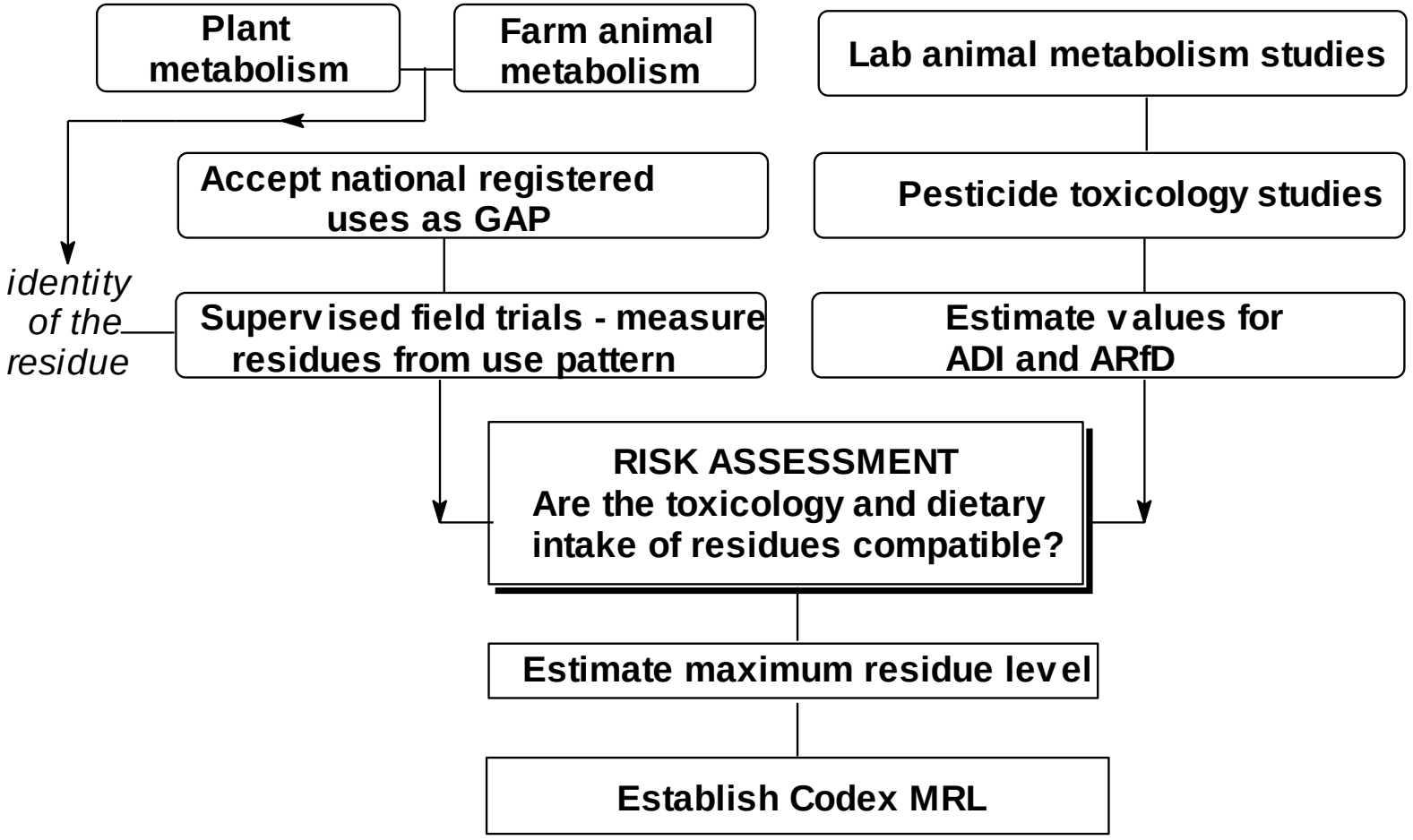
- Processed food products such as bean sprouts, starch vermicelli, bean paste, etc.

- During processing, resulting in the enrichment or degradation?

2. Pesticide maximum residue limits (MRLs)

- 2.1 Establish procedures of MRLs
- 2.2 Current MRLs
- 2.3 Future Perspective

2.1 Establish procedures of MRLs



Good Agricultural Practice

- Good agricultural practice in the use of pesticides (GAP) includes the nationally authorized safe uses of pesticides under actual conditions necessary for effective pest control. It encompasses a range of levels of pesticide applications up to the highest authorized use, applied in a manner, which leaves a residue, which is the smallest amount practicable.
- Authorized safe uses are determined at the national level and include nationally registered or recommended uses, which take into account public and occupational health and environmental safety considerations.
- Actual conditions include any stage in the production, storage, transport, and distribution of food commodities and animal feed. (CAC, 1995)

- NO GAP = no possible MRL (except the “pilot project”)

GAP examples and Supervised Field trials

Registered uses of folpet on vegetables and cereals.

Crop	Country	Form	Application [1]				PHI, days
		ai	Method	Rate kg ai/ha	Spray conc., kg ai/hl	Number	
Barley	France			1.5			21
Beans	Greece	WP	foliar	0.6-1.5	0.1-0.25	3-4	7
Beans	Portugal	WP	foliar		0.13	1-2	7
Beans, green	Spain	WP	foliar	1.6	0.16		21
Brassica vegetables	Italy	WP	foliar	0.35-0.40			10
Lettuce	France	WP	foliar	0.64			21-41[2]
Lettuce	Israel[3]	WP	foliar	2.0		weekly	11

2.1 Establish procedures of MRLs

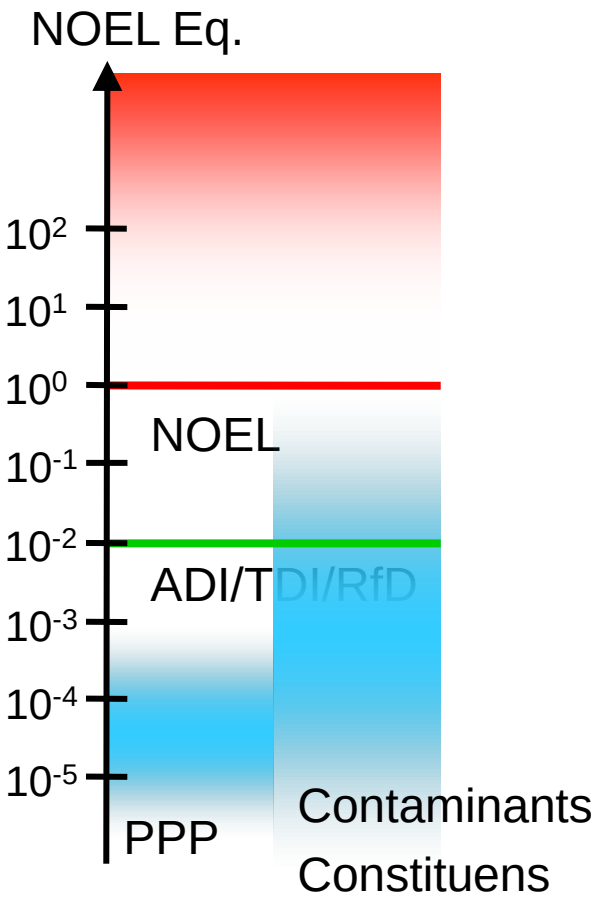
- 2.1.1 Ensure ADI (acceptable daily intake)

Recommended by JMPR;

Refer to EPA's reference doses;

ADIs of other countries;

Refer to NOAEL (no-Observed-adverse-effect level).



2.1 Establish procedures of MRLs

- 2.1.2 Ensure STMR (supervised trials median residue) and HR (high residue)

Develop residue trials under GAP conditions.

According to the results , ensure STMR and HR.

2.1 Establish procedures of MRLs

- NEDI (national estimated long-term daily intake)

$NEDI = \sum [(STMR_i \times F_{i*} \times P_{i*} \times E_{i*})]$

$STMR_i$— pesticide's STMR in a food;

F_i— consumption of certain foods in general population.

NESTI (National Estimated short-term daily intake)

U< 25g $NESTI = HR \times LP / bw\ (kg)$

- $IESTI = (HR-P) \times LP / bw\ (kg)$

- 2.1.4 Recommended MRLs

NEDI/(ADI*bw) < 100%; NESTI< ARfD; acceptable.

2.2 Current MRLs

Bean MRLs (47 compounds)

	US	Cod	EU	Chn	Jpn
Thiophanate-methyl	0.2	0.5	0.3	---	1
Zeta-Cypermethrin	0.05	0.05	0.05	---	0.05
2,4-D	0.02	*{0.01}*	0.1	---	0.05
2,4-DB	0.5	---	*{0.05}*	---	*{0.2}*
Acephate	1	*{0.3}*	*{0.3}*	---	*{0.5}*
Aldicarb	0.02	0.02	0.05	---	0.02
Azoxystrobin	0.5	0.5	0.5	---	0.5
Bentazon	0.05	0.05	0.1	0.05	0.05
Bifenthrin	0.2	---	*{0.1}*	---	*{0.1}*
Boscalid	0.1	---	0.5	---	0.1
Captan	0.05	---	*{0.02}*	---	5
Carbaryl	0.5	*{0.2}*	*{0.05}*	1	*{0.2}*
Carboxin	0.2	---	0.2	---	0.2
Carfentrazone-ethyl	0.1	---	*{0.02}*	---	0.1
Chlorothalonil	0.2	---	*{0.01}*	---	0.2
Chlorpyrifos	0.3	*{0.1}*	*{0.05}*	---	0.3
Clethodim	10	10	10	---	10
Deltamethrin	0.1	1	*{0.05}*	0.5	0.1
Dimethenamid	0.01	0.01	0.02	---	0.1

Dimethoate	0.05	---	0.05	0.05	1
Diquat dibromide	0.2	0.2	0.2	---	0.2
Fluazifop	2.5	---	5	*{0.5}*	*{1}*
Fludioxonil	0.01	---	0.05	---	0.1
Flumioxazin	0.02	---	0.1	---	0.02
Fluoride	70	---	*{2}*	---	---
Fluoxastrobin	0.05	---	0.05	---	---
Glufosinate-ammonium	2	2	2	---	2
Glyphosate	20	20	20	---	20
Indoxacarb	0.8	5	*{0.5}*	---	*{0.5}*
Lambda Cyhalothrin	0.01	0.05	0.05	---	0.2
Metalaxyl	1	*{0.05}*	*{0.1}*	---	*{0.05}*
Metconazole	0.05	---	0.05	---	---
Methomyl	0.2	0.2	*{0.1}*	0.2	0.2
Methoxyfenozide	1	---	2	---	*{0.3}*
Methyl Parathion	0.1	---	*{0.05}*	---	0.1
Metolachlor	0.2	---	*{0.1}*	0.5	0.2
Metribuzin	0.3	---	*{0.1}*	---	*{0.1}*
Myclobutanil	0.25	---	*{0.05}*	---	*{0.05}*
Oxamyl	0.1	---	*{0.02}*	---	0.1
Oxyfluorfen	0.05	---	0.05	---	0.05
Paraquat dichloride	0.7	*{0.5}*	*{0.02}*	---	*{0.1}*
Pentachloronitrobenzene	0.02	*{0.01}*	0.02	*{0.01}*	*{0.01}*
Permethrin	0.05	0.05	0.05	2	0.05
Phosphine	0.1	---	*{0.05}*	*{0.05}*	0.1
Propiconazole	2	*{0.07}*	*{0.1}*	---	*{0.05}*
Pyraclostrobin	0.04	0.05	*{0.02}*	---	0.04

2.3 Future Perspective

The validity of extrapolation in setting MRLs for pesticides in bean crops

a. Establish crop grouping system
b. According to residue trials results, research and determine crop group or extrapolation the MRLs

2.3 Future Perspective

- 2.3.1 Minor crops

Minor crops contain small acreage crops, pesticides ‘minor use’ and ‘specialty crops’.

e.g. Soybean is the major crop;

Mung bean, red bean, peas and other are small crops.

2.3 Future Perspective

- 2.3.2 Residue extrapolation

Field trials were initiated to investigate if extrapolation procedures, which were adopted to limit costs of pesticide registration for minor crops, are valid.

2.3 Future Perspective

- 2.3.3 How to extrapolate residue

a. Establish plant crops group and subgroup

b. Choose representative crops

c. Study residues on the representative crops

d. Calculation of MRLs

e. Apply the results into the crops group and subgroup

Extrapolation and group tolerances

- Experience and scientific basis on Extrapolation and group tolerances
- Guidelines are ongoing by CAC, OECD etc
- Expert judgment: all available data including residues trails and GAPs

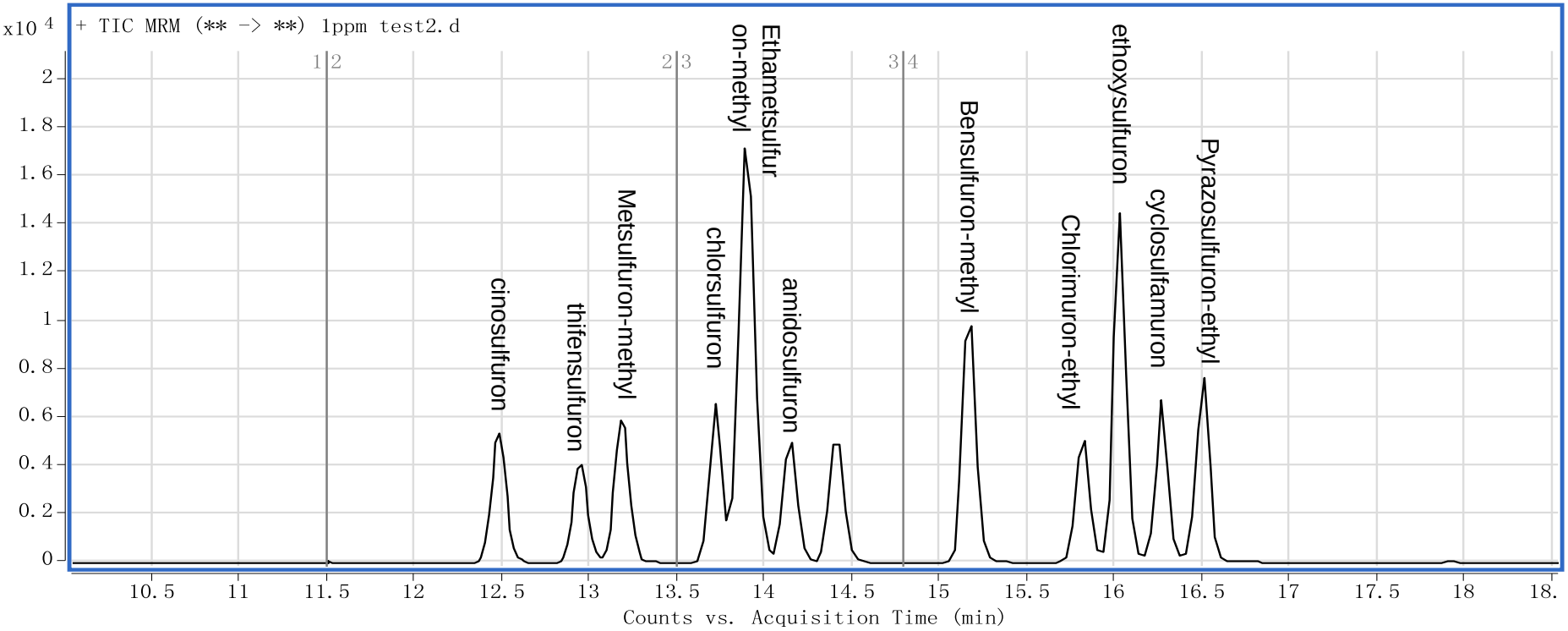
3. Analytical issues on bean products

Application of pesticides, herbicides, fungicides and hormones on bean crops and products:

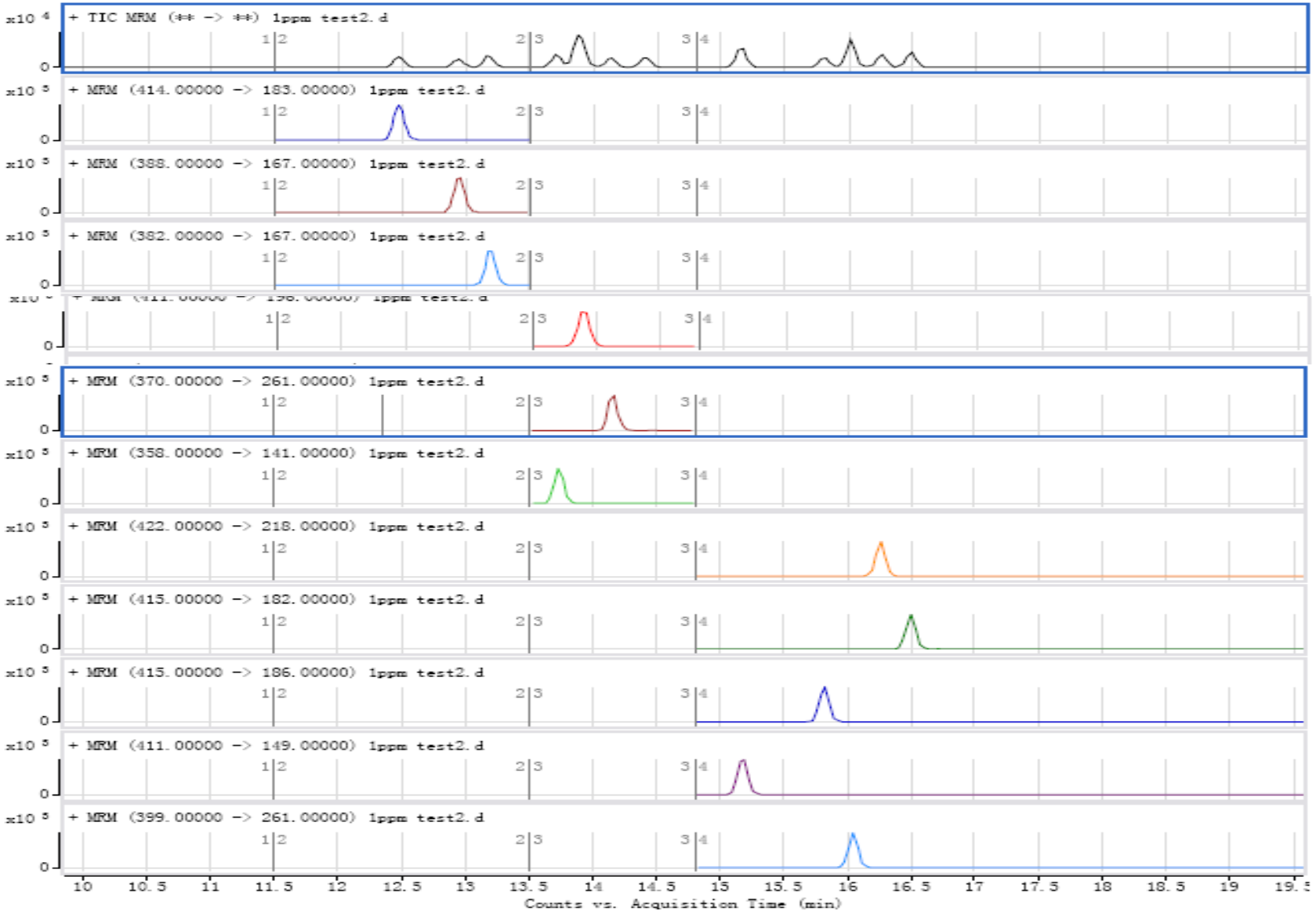
- When planting
- When processing (enrichment or degradation)
- When storage

3.1 Determination of 11 sulfonylurea herbicides in bean products by LC-MS/MS

TIC spectrum of 11 sulfonylurea herbicides by LC-MS/MS



MRM spectrum of 11 sulfonylurea herbicides by LC-MS/MS



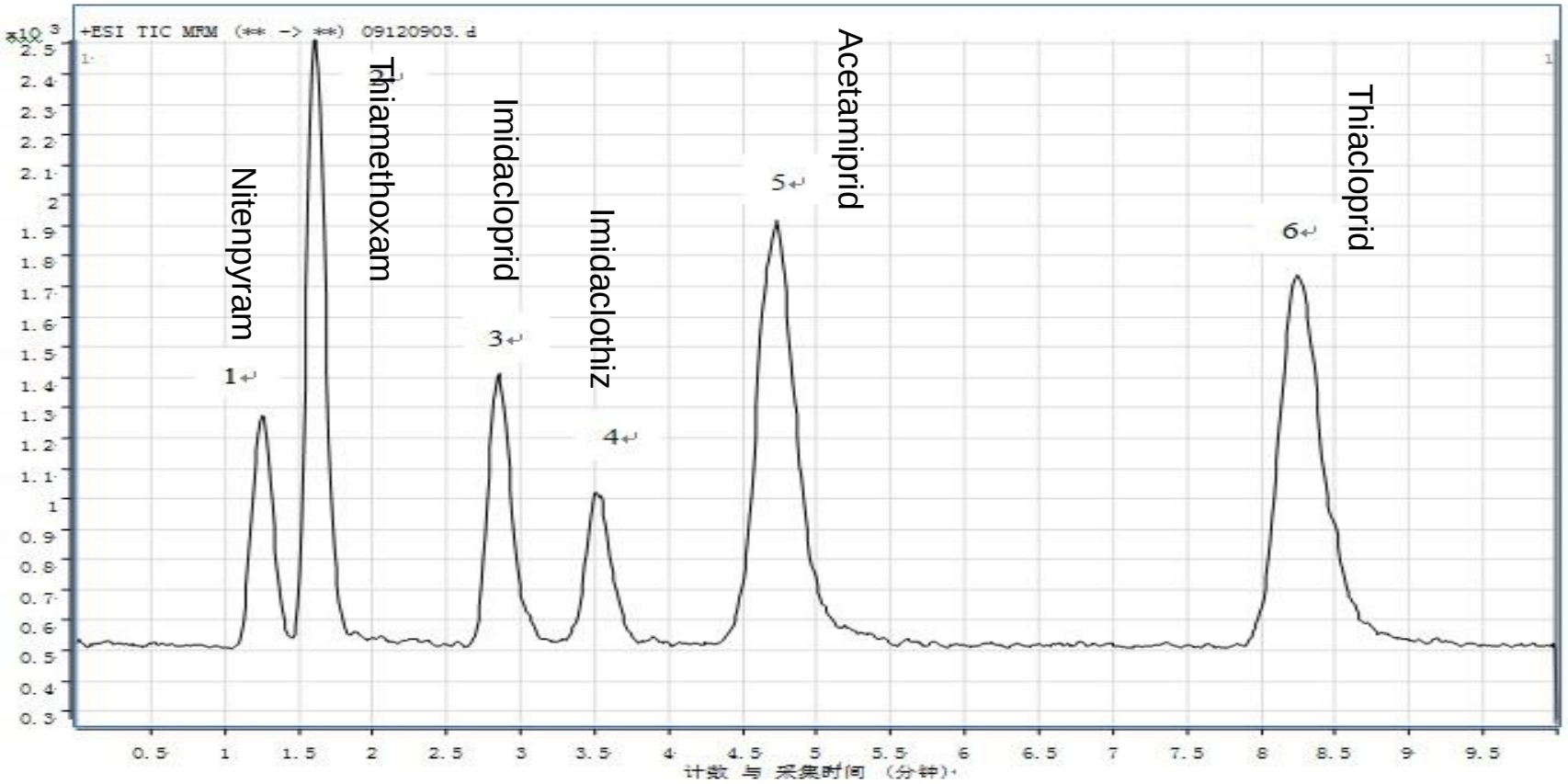
3.1 Determination of 11 sulfonylurea herbicides in bean products by LC-MS/MS

Recovery

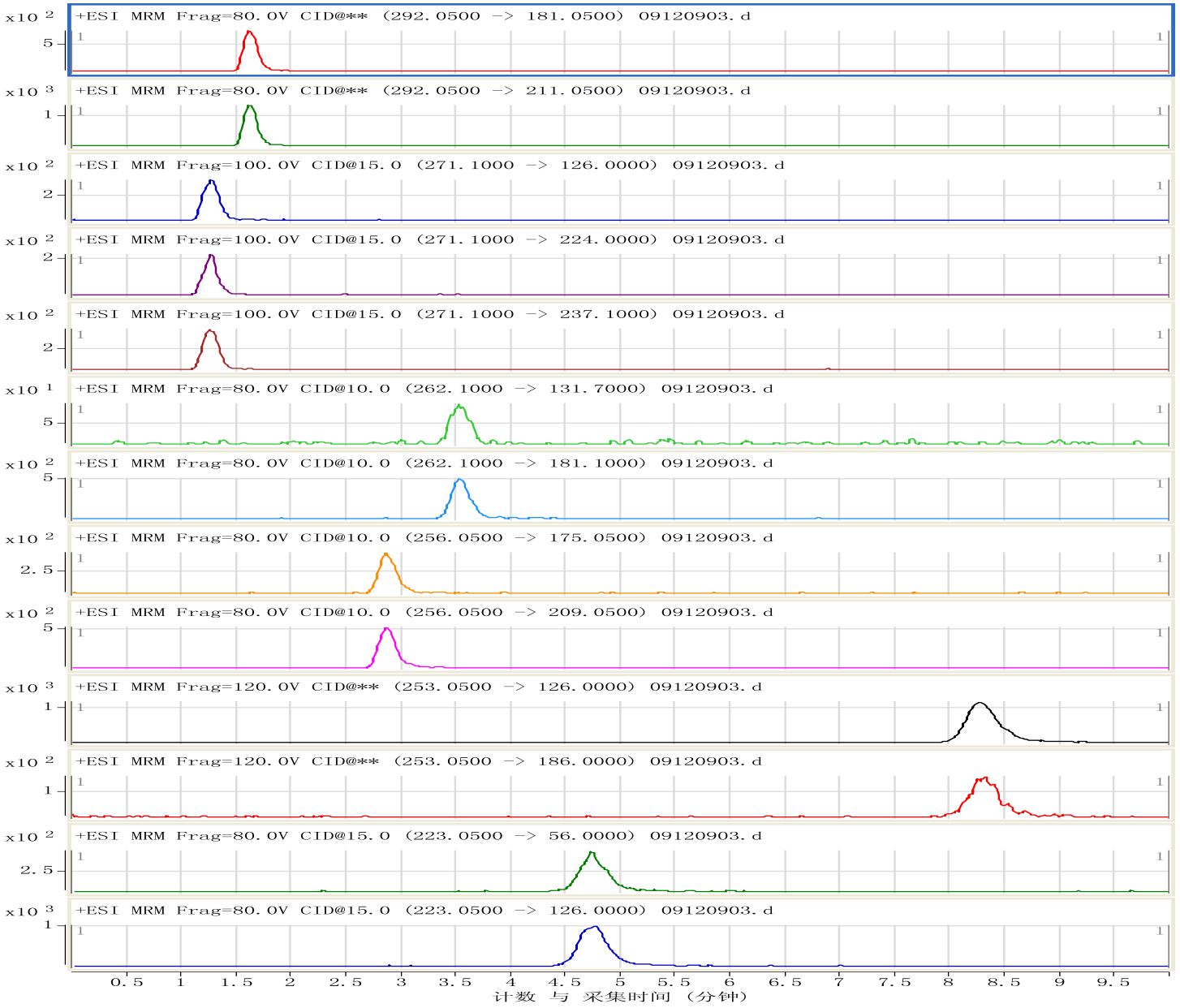
herbicides	0.01 mg/kg		0.02 mg/kg		0.1 mg/kg	
	recovery%	RSD%	recovery%	RSD%	recovery%	RSD%
Chlorsulfuron	83.3	10.4	68.8	5.3	69.1	13.6
Amidosulfuron	96.7	8.2	75.4	6.9	87.6	4.3
Metsulfuron-methyl	103.8	10.5	70.5	8.7	74.5	6.6
Thifensulfuron-methyl	82.7	4.6	66.5	6.2	75.6	14.3
Ethoxysulfuron	102.9	6.3	99.4	12.8	74.2	10.8
Ethametsulfuron-methyl	99.8	12.9	84.9	8.1	73.0	8.0
Bensulfuron-methyl	105.5	12.2	69.1	7.8	71.1	14.7
Cinosulfuron	73.5	7.4	66.9	4.5	68.5	18.0
Chlorimuron-ethyl	112.7	5.3	74.9	5.2	70.9	10.1
Pyrazosulfuron-ethyl	104.4	4.9	79.0	10.5	78.9	14.5
cyclosulfamuron	105.0	8.4	87.2	11.2	68.2	15.8

3.2 Determination of 6 nicotinoid pesticides in bean products by LC-MS/MS

TIC spectrum of 6 nicotinoid pesticides by LC-MS/MS



MRM spectrum of 6 nicotinoid pesticides by LC-MS/MS



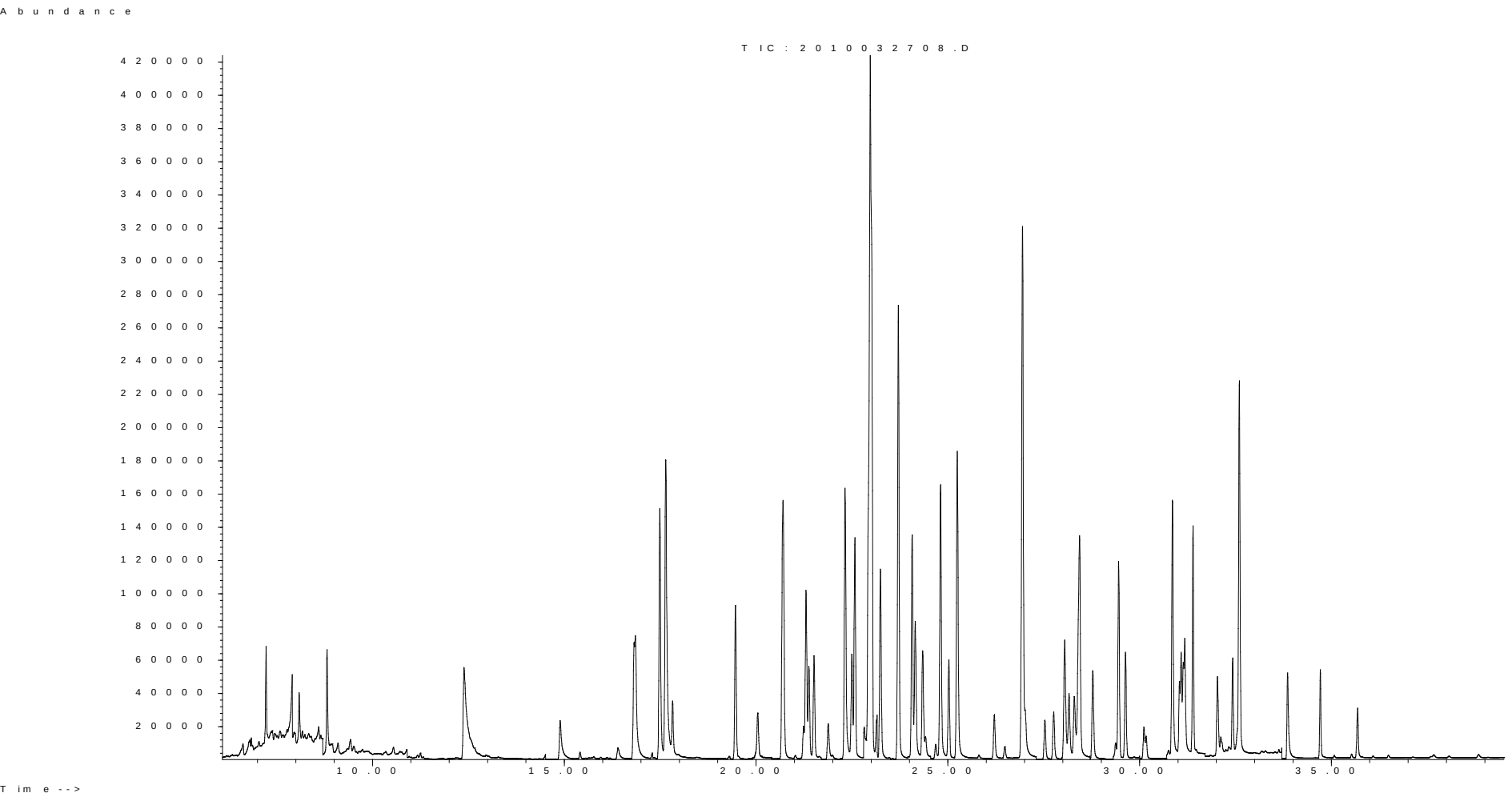
3.2 Determination of 6 nicotinoid pesticides in bean products by LC-MS/MS

Recovery

		1/%	2/%	3/%	4/%	5/%	average/%	RSD%
Nitenpyram	0.1	84.3	74.5	74.2	81.9	73.8	77.7	6.4
	0.5	86.0	84.6	78.9	80.1	87.1	83.4	4.4
	1	81.3	87.6	89.4	86.1	88.7	86.6	3.7
Thiamethoxam	0.1	98.9	104.3	104.6	90.7	100.3	99.8	5.7
	0.5	87.8	96.2	88.7	81.4	99.0	90.6	7.7
	1	98.2	100.1	102.6	102.5	103.9	101.5	2.3
Imidacloprid	0.1	96.8	87.7	97.0	92.9	91.8	93.2	4.2
	0.5	85.6	100.1	104.9	92.7	101.4	96.9	8.0
	1	99.7	106.3	104.4	103.1	105.3	103.8	2.5
Imidaclothiz	0.1	75.8	86.2	89.9	91.2	85.3	85.7	7.1
	0.5	93.9	97.3	103.6	94.5	101.1	98.1	4.3
	1	91.2	99.4	93.5	92.4	100.7	95.4	4.5
Acetamiprid	0.1	98.5	94.3	94.2	95.2	89.2	94.3	3.5
	0.5	90.7	98.3	94.7	90.3	94.5	93.7	3.5
	1	97.9	96.5	103.1	98.6	95.1	98.2	3.1
Thiacloprid	0.1	93.9	76.9	79.9	89.6	75.9	83.3	9.7
	0.5	69.6	88.9	81.6	79.9	85.3	81.0	9.0
	1	90.1	97.3	94.6	81.5	96.6	92.0	7.1

3.3 Determination of 60 pesticides in bean products by GC-MS

- TIC spectrum of 60 pesticides by GC/MS



3.3 Determination of 60 pesticides in bean products by GC-MS

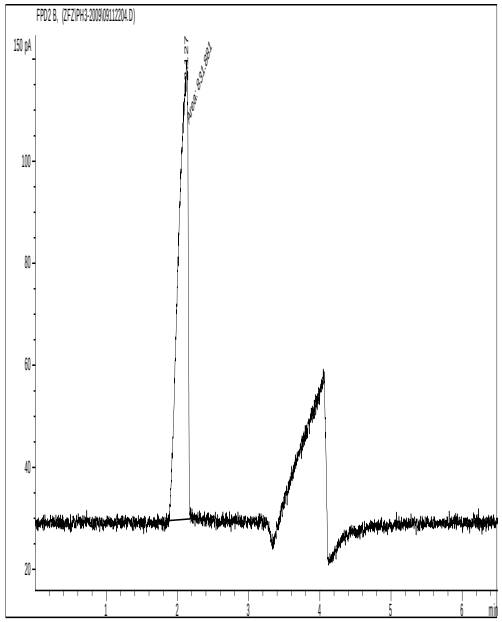
- Recovery

		0.02		0.10		0.50				0.02		0.10		0.50	
		Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)			Recovery (%)	RSD (%)	Recovery (%)	RSD (%)	Recovery (%)	RSD (%)
1	propoxur			92.91	0.08	102.08	0.04	32	butachlor	75.86	0.12	99.82	0.02	102.55	0.04
2	etridiazole	105.49	0.11	88.91	0.14	87.96	0.15	33	flutriafol	113.04	0.06	96.91	0.07	98.24	0.06
3	chlorpropham	101.28	0.09	110.30	0.07	98.51	0.06	34	napropamide	76.67	0.09	104.84	0.02	107.77	0.04
4	methomyl			83.46	0.07	95.41	0.05	35	profenofos	103.93	0.14	104.00	0.09	94.87	0.05
5	dimethoate			87.23	0.08	101.65	0.05	36	pretilachlor	83.93	0.09	104.68	0.03	108.36	0.02
6	atrazine	80.11	0.19	102.76	0.05	96.80	0.08	37	uniconazole	99.04	0.09	87.43	0.15	99.07	0.03
7	clomazone	92.00	0.04	105.42	0.01	103.47	0.04	38	oxadiazon	79.22	0.10	116.45	0.03	88.49	0.14
8	propyzamide	90.38	0.08	107.25	0.06	109.74	0.04	39	flusilazole	82.62	0.05	38.73	1.06	103.06	0.05
9	dicamba	94.00	0.08	102.83	0.07	108.22	0.04	40	oxyfluorfen	77.46	0.11	100.28	0.06	98.48	0.12
10	metribuzin	106.79	0.09	73.96	0.05	105.13	0.03	41	RH-5849	103.68	0.04	100.85	0.03	104.90	0.09
11	diazinon	71.52	0.06	134.74	0.02	98.60	0.08	42	propiconazole	95.40	0.01	105.12	0.04	101.44	0.03
12	bromoxynil	99.57	0.02	76.36	0.08	89.83	0.08	43	hexazinone	89.98	0.07	94.65	0.09	88.50	0.06

13	acetochlor	85.16	0.07	107.19	0.01	101.56	0.04	44	tebuconazole	100.92	0.08	99.99	0.03	99.91	0.07
14	propargite	101.07	0.07	97.58	0.07	93.16	0.06	45	thiabendazole	83.83	0.07	93.94	0.08	106.45	0.05
15	pirimiphos-methyl	78.81	0.06	96.33	0.02	104.47	0.03	46	diclofop-methyl	86.51	0.08	101.51	0.02	101.27	0.04
16	ethofumesate	96.13	0.09	109.72	0.03	108.65	0.05	47	diflufenican	77.16	0.11	88.79	0.02	98.89	0.02
17	fenthion	83.76	0.07	89.49	0.04	99.40	0.07	48	epoxiconazole	90.46	0.03	101.21	0.04	105.38	0.03
18	chlorpyrifos	104.22	0.05	89.85	0.02	100.03	0.03	49	tetramethrin	89.51	0.09	89.24	0.24	109.82	0.07
19	triadimefon	109.56	0.04	100.10	0.06	98.58	0.08	50	tricyclazole			88.40	0.11	99.86	0.15
20	flurochloridone	86.71	0.12	89.14	0.05	102.78	0.03	51	bifenox	102.09	0.10	91.90	0.09	99.93	0.02
21	cyprodinil	75.68	0.09	77.28	0.03	88.28	0.02	52	anilofos	70.18	0.11	80.88	0.13	81.87	0.09
22	Pendimethalin	87.53	0.08	89.23	0.04	98.72	0.07	53	pyriproxyfen	67.63	0.18	130.86	0.01	99.83	0.02
23	metazachlor	87.97	0.08	104.01	0.03	99.05	0.05	54	cyhalofop-butyl	89.00	0.10	110.57	0.04	109.29	0.03
24	allethrin	98.51	0.13	99.31	0.04	97.86	0.06	55	lanbda-cyhalothrin	98.58	0.06	93.20	0.03	111.68	0.06
25	chlorfenvinphos	93.82	0.12	108.43	0.08	104.54	0.03	56	tralkoxydim	86.02	0.12	72.17	0.07	69.97	0.03
26	phenoxyacetic acid	76.78	0.13	101.32	0.05	103.10	0.05	57	fenoxaprop-P-ethyl	89.07	0.15	102.66	0.10	87.46	0.07
27	S-bioallethrin	85.35	0.12	95.86	0.03	105.75	0.05	58	permethrin	86.63	0.10	89.43	0.03	88.66	0.02
28	procymidone	83.56	0.07	101.62	0.06	105.95	0.05	59	bifenthrin	100.87	0.17	109.26	0.03	92.29	0.01
29	paclobutrazol	83.59	0.05	91.92	0.07	104.86	0.02	60	pyridaben	82.04	0.07	98.93	0.03	96.21	0.04
30	Haloxyfop-R-methyl	76.57	0.12	106.33	0.03	87.54	0.06	61	quizalofop-P	73.85	0.14	102.11	0.08	105.93	0.04
31	cartap hydrochloride	73.84	0.13	103.12	0.01	101.51	0.04								

3.4 Determination of phosphide (expressed as phosphine in bean products by GC

Gas chromatography spectra of phosphine



Aluminum phosphide;
magnesium phosphide

On cereal grains and bean products storage

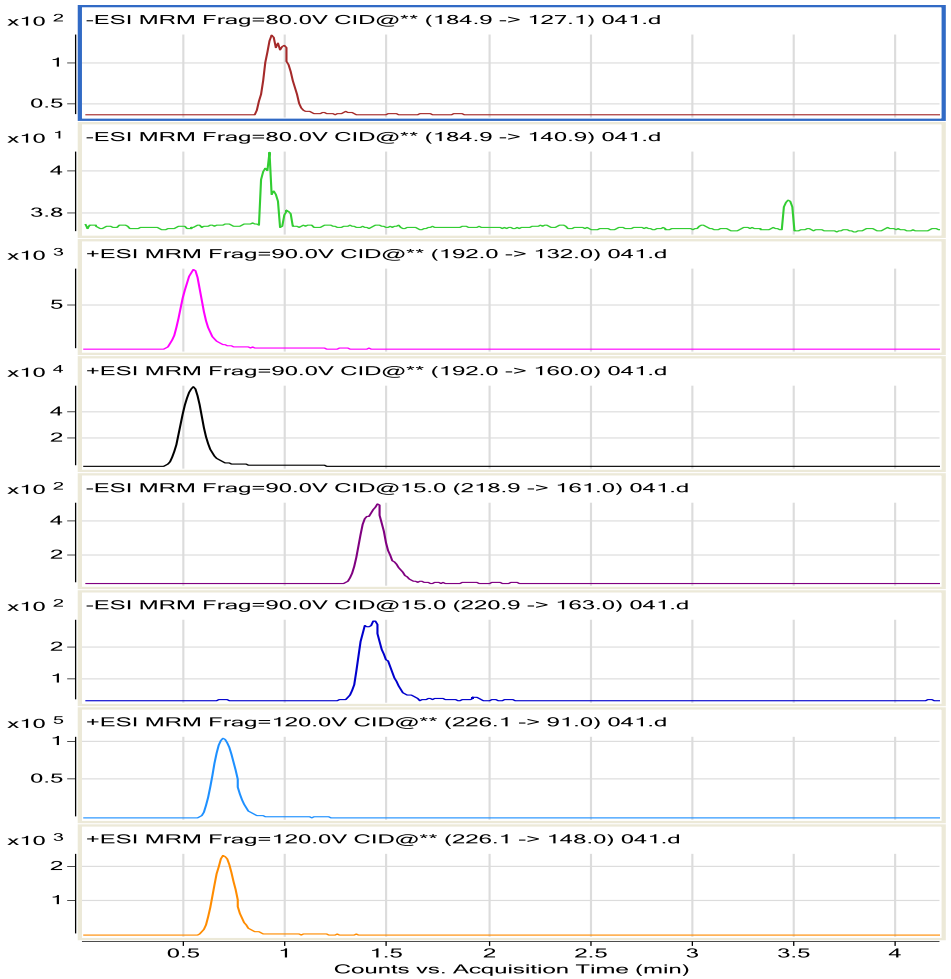
3.4 Determination of phosphide (expressed as phosphine in bean products by GC

Method validation:

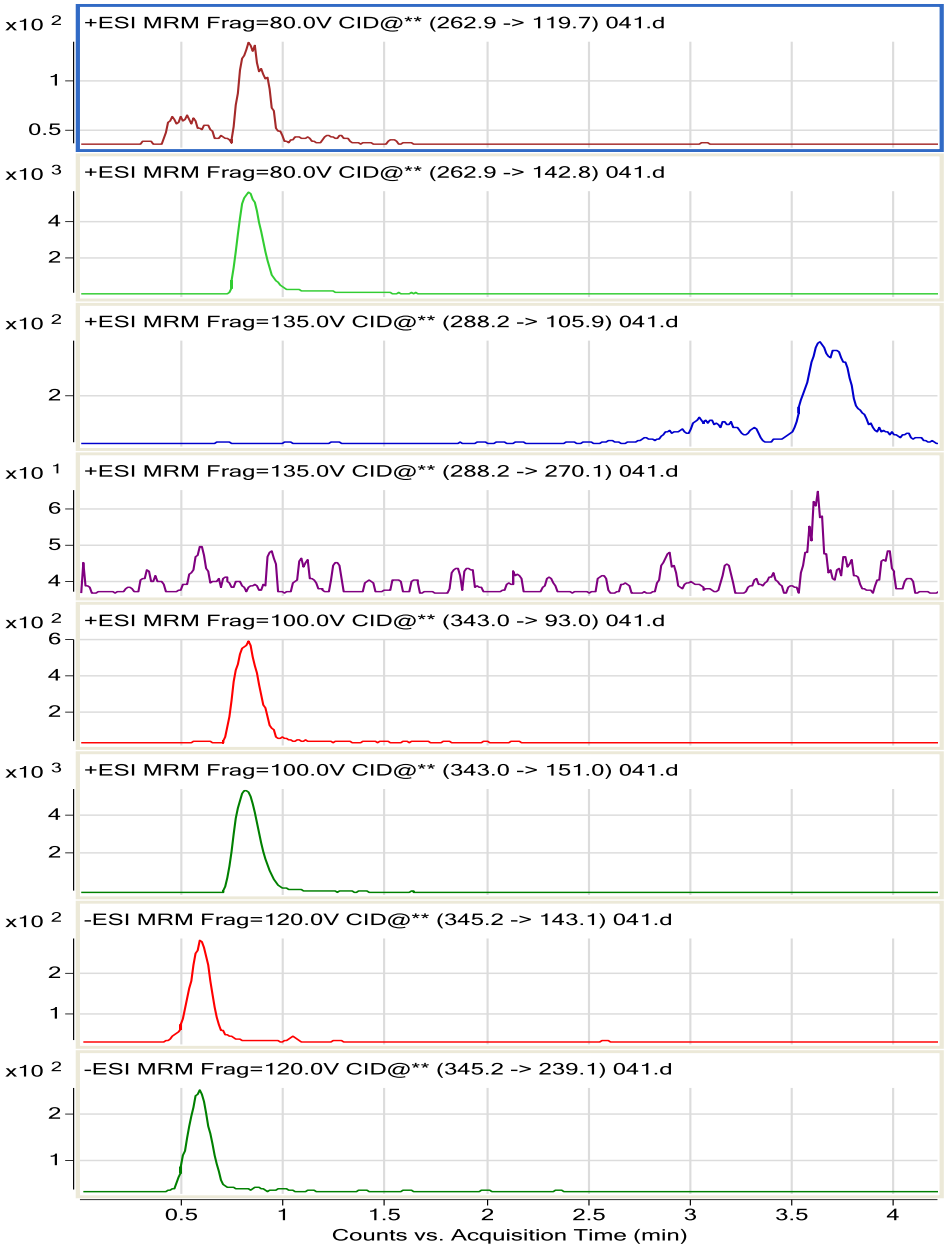
		recovery(%)					average(%)	RSD(%)
phosphine	1	118.7	115.5	117.0	117.8	113.5	116.5	1.7
	0.1	76.5	79.1	71.3	74.8	76.0	73.5	9.0
	0.05	81.7	104.3	93.5	99.6	85.3	92.9	10.2
	0.02	90.2	97.4	91.4	103.1	90.7	94.6	5.9

3.5 Research of 6 pesticides distribution and metastasis when sprout growth

MRM spectrum of 6 pesticides by LC-MS/MS



MRM spectrum of 6 pesticides by LC-MS/MS



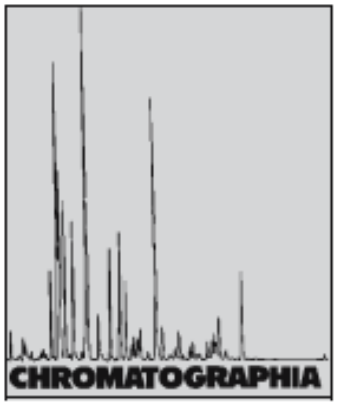
Carbendazim

Gibberellic

2,4-D

4-chlorophenoxy

Determination of Organophosphorus Pesticides in Soybean Oil, Peanut Oil and Sesame Oil by Low-Temperature Extraction and GC-FPD



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3.6 Future Perspective

- Determination of AFT, OTA, ZON, DON, FUM and T-2 toxins etc. in bean products
- Other processing factor studies, especially those make enrichment of residue.

4. Discussions

- 4.1 Global Joint Reviews of New Pesticide Active Ingredients
- 4.2 International Crop Grouping Activities
- 4.3 MRL calculator
- 4.5 New progresses at 43th CCPR, Xi’an 2010

4.1 Global Joint Reviews of New Pesticide Active Ingredients

- Goals：

a. Harmonize endpoints (ADIs; ecotox concerns) and MRLs to the greatest extent possible.

b. Maximizing resources

c. Broad scientific expertise and peer review

d. Global market access for reduced risk pesticides

4.1 Global Joint Reviews of New Pesticide Active Ingredients

- Global Joint Reviews are fast becoming the standard way of doing business
- Harmonization issues still challenging
- Many advantages are evident
- All authorities are invited and welcomed to participate

4.2 International Crop Grouping Activities

- There are various ongoing crop grouping efforts including work by Codex, OECD and countries.
- Intent is that all countries will participate in this effort and then countries will adopt the crop groups for purposes of setting maximum residue levels (MRLs).

Global Minor Use Summit

- Work to increase the number of Codex MRLs for specialty crops and minor uses.

- Support Codex in revising Codex Classification of Food and Animal Feeds, including consideration of the concept of representative commodities.

Suggestion

- Improve the pesticide registration system.
- Enhance pesticide studies on minor crops , and improve the safety evaluation of pesticides.
- Create a communication platform for sharing information on minor crops.
- Strengthen international cooperation and exchanges, and promote pesticide registration on minor crops.
- Minor crops can be similar as the spices at market monitoring.

MRL calculator (OECD)

The mean and the standard deviation values of the dataset are computed:

The calculated MRL is the maximum taken from 3 calculations:

- 4*standard deviation
- 3*mean*CF
- HR

MRL= Maximum (mean + 4*standard deviation, 3*mean*CF, HR).

Finally the calculated MRL is rounded as necessary

Different statistical strategy? (NAFTL)

JMPR choice?

4.5 New progresses at 43th CCPR

- Risk assessment principles: 15 years after, what happed to the active ingredients?
- Codex classification of foods and feeds
- Proposed draft principles and guidance for the selection of representatives commodities for the extrapolation of MRLs to commodity groups
- Pilot project: MRL before national registration
- Residue data requirement: 3 data for coffee bean? Other minor crops
- Uncertainty of residue analysis: Australia and China Co-Chair the EWG.

5. Conclusion

- It is important to use pesticides scientifically in bean products and protect food safety.
- Establish MRLs on bean crops (both major and minor crops) and processed bean products.
- Studies on determination of pesticide residues are carrying on.
- There are still problems should be resolved by the joint efforts of the international community.

Thank you for your kind attention!

Welcome comments!

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