MINUTES OF 396th (SPECIAL MEETING) MEETING OF REGISTRATION COMMITTEE HELD ON 29.11.2018 IN THE CHAMBER OF DR. S. K. MALHOTRA, ROOM NO. 231, KRISHI BHAWAN, NEW DELHI.

The 396th (Special Meeting) Meeting of Registration Committee (RC) was held under the Chairmanship of Dr. S. K. Malhotra, Agriculture Commissioner on 29.11.2018 at 10:00 AM in Committee Room No. 1, ICAR, Krishi Bhawan, New Delhi, to discuss importance issues w.r.t. Crop Grouping and Pesticide Residue data requirements for registration of pesticide Dr. P. K. Chakarbarty, ADG (PP), ICAR, Krishi Bhawan, New Delhi; Dr. B. Sivakumar Reddy (Representative of Drugs Controller General of India,), Ministry of Health and Family Welfare, FDA Bawahn, New Delhi; Dr. K. K. Sharma, Project Coordinator, AINP on Pesticides Residue, Division of Agriculture, IARI, New Delhi; and Dr. D.D.K. Sharma, Addl. Plant Protection Adviser & Secretary, CIB&RC, Faridabad attended the meeting. Following officers from the Secretariat of CIB&RC were also present to assist the Committee:

1. Dr. Sandhya Kulshrestha, Consultant (Pharma)
2. Dr. Archana Sinha, JD (Chem.)
3. Dr. Arnav Das Gupta, JD (PP)
4. Sh. Hariom Miglani, Sr. Law Officer
5. Sh. A. Krishna Reddy, DD(WS)
6. Miss Kamlesh Miglani, DD (Chem.)
7. Sh. Kiran W. Deshkar, DD (E)
8. Sh. Vivek Narayan, Sr. Administrative Officer
9. Sh. Niraj Kulshrestha, Law Officer
10. Sh. R. B. Sharma AD (Chem.)
11. Sh. Avnish Tomar, AD (Chem.)

At the outset, Chairman welcomed the members and asked APPA & Secretary, CIB&RC who is holding charge of PPA also to take up the agenda for deliberation. The Chairman acknowledged the efforts and hard works of Dr. D. D. K. Sharma, APPA & Secretary (CIB&RC) who will be superannuate on 30.11.2018. The agenda wise decisions taken by the RC are as under:-

Agenda item No.	Particulars of Agenda
1.0	**Confirmation of minutes of the 395th RC meeting of the Registration Committee.**
	The draft minutes of 395th meeting were placed before the RC. The Same were confirmed with minor modifications.

2.0	**Presentation**
	NIL
3.0	**Government Business**
3.1	**Report of the sub-committee on implementation of crop grouping principles for extending label claims under the chairpersonship of Dr. P. K. Chakrabarty, ADG (PP &B)**
	Department of Agriculture, cooperation and Farmers Welfare constituted a sub-committee under the chairmanship of Dr. T. P. Rajenderan, former ICAR-Assistant Director General (Plant Protection) in March, 2013 to study the aspects of crop grouping within the draft principles of Codex Committee for Pesticides Residue (CCPR). The report of the committee was considered by the Registration Committee (RC) in its 354th meeting held on 31.03.2015 and 360th meeting held on 11.12.2015 respectively. In its 369th meeting held on 04.10.2016 and constituted a sub-committee under the Chairmanship of Dr. P. K. Chakarbarty, ADG (PP), ICAR & Member of RC to recommend the procedure to implement Crop grouping principles while protecting the environment and human beings within the ambit of the Insecticides Act. The sub-committee presented its report (Annexure-3.1.1) before the RC in its 395th (special meeting). The RC appreciated the report and noted that the principles of crop grouping are applied in many developed countries to grant registration/fix MRL and this report will facilitate our country also to adopt the same principles in the scientific manner. The committee decided that the report may be placed on the website for suggestion of the stake holders within 15 days if any and brought to next RC meeting for adoption.
3.2	**Report of the committee on Persistence Studies in Plant**
	The Registration Committee (RC) noted that in its 380th meeting held on 20.11.2017 constituted the expert committee under the Chairmanship of Dr. K. K. Sharma, Network Coordinator, ICAR-AINP on Pesticides Residue, IARI, New Delhi to suggest the Field Persistence studies in plant and their analytical test studies in plant samples. The expert committee held 4 meetings for finalize the recommendations. The report (Annexure 3.2.1) was presented in the Registration Committee in its 395th meeting. The committee appreciated the report and decided that the report may be placed on the website for suggestion of the stake holders within 15 days if any and brought to next RC meeting for adoption.

Annexure 3.1.1

Report of the sub-committee on implementation of crop grouping principles for extending label claims under the chairpersonship of Dr. P. K. Chakrabarty, ADG (PP &B)

Background

The concept of crop grouping aims at uniting crops into a group or subgroup to facilitate use of pesticides in as many crops as scientifically possible. Globally, concerted efforts are being made for the implementation of Crop Grouping to so that the growers have access to new and effective crop protection tools and technologies. In India, one of the major issues is that there is label claim for use of pesticides in only 15-20 % crops. This also becomes a major limiting factor in the export of agricultural produce.

The process of label claim approval of a particular crop-pesticide combination is time consuming and usually requires 4-5 years with considerable monetary inputs. Due to such immense efforts, time and cost necessitated, label claim on many crops is usually not taken up, specifically for minor crops. For example, there are a number of crops on which a particular pesticide finds its use, but the overall market potential does not justify the expenses for bio-efficacy and residue data generation/ fixation of MRLs on such crops as these are cultivated in relatively smaller geographies. Such crops, in the Indian context, are generally referred to the commodities that require very low agro-inputs for cultivation but due to dietary value and importance in international trade these are very vital for the country. Out of approximately 280 registered pesticides in India, labelled use is restricted to less than 100 crops of the 554 crops (<15%). The absence of label claims for spices, fruits, leafy vegetables etc. leave farmers with fewer / limited pest management options. In addition, they also bear the risk of rejection in international trade on account of off-label use of the pesticide and the absence of country MRLs.

Chronology of Events

The Department of Agriculture, Co-operation & Farmers Welfare constituted a sub-committee under the Chairmanship of Dr. T.P. Rajendran, former ICAR-Assistant Director General (Plant Protection) in March 2013 to study the aspects of crop grouping within the draft principles of Codex Committee for Pesticide Residues (CCPR).

The Members of the Sub-committee included:

1. Dr. T.P. Rajendran, the then Assistant Director General (PP), ICAR & Officer on Special Duty, National Institute of Biotic Stress Management, Raipur (Chairman)
2. Dr. K.K. Sharma, Network Coordinator, ICAR-AINP on Pesticide Residues, ICAR-IARI, New Delhi (Member)
3. Dr. A. Madhavan, Food Safety Standards Authority of India, FDA Bhawan, Kotla Road, New Delhi (Member)
4. Dr. B.S. Phogat, Asst. Plant Protection Advisor & Secretary (CIB & RC), Directorate of Plant Protection Quarantine and Storage, Faridabad. (Member)
5. Dr. P.S. Chandurkar, Consultant, Directorate of Plant Protection Quarantine and Storage, Faridabad. (Member)
6. Dr. S.N. Sushil, Plant Protection Advisor, Directorate of Plant Protection Quarantine and Storage, Faridabad. (Convener)

Based on the published final report of the Committee on Crop Grouping, over five hundred and fifty four Indian crops were grouped into definitive Crop Types / Crop Groups / Crop Sub-groups through similarities in their botanical classification, morphology, growth habit, the portion of the commodity harvested and/or consumed, and cultural practices. This report was based on the Codex Guidelines of crop grouping focusing on the **(1) principles and guidance on the selection of representative commodities and (2) classification of crop commodities with representative commodities.** Representative crops under the crop commodity

group were identified, which is subject to amendment under varying situation of trade patterns, perception of risks on pesticide residues and the introduction of new crops in the country for cultivation. For residue purposes, these 'representative crops' are typically those which are:

1. Most likely to contain the highest residues
2. Major in terms of production and/or consumption, and
3. Similar in morphology, growth habit, pest problems and edible portion to those other commodities within the group.

The committee also recommended:

a. Extrapolation of existing MRLs of the given pesticide substance to those crops within the same Crop Group / Sub-group of crops and termed as Group MRL within the principles and guidance.

b. Crop grouping needs to be reviewed, keeping in view the revisions at CCPR level.

c. The report of the Committee may be considered as the National document on Crop Grouping with reference to the fixation of maximum residue limit (MRL) of pesticides in agricultural commodities by the Food Safety Standard Authority of India.

The said document was published by CIB&RC on their website for inviting comments from Stakeholders. The Registration Committee in its 354th meeting held on 31st March 2015 decided to seek views of Food Safety and Standards Authority of India (FSSAI) for adopting the crop grouping principles for determination of their MRLs for different categories of crops grown in India. FSSAI, in principle, consented Crop Grouping approach of data generation and MRL Fixation. Subsequently, based on comments of FSSAI, the registration committee in its 360th meeting held on 11th December 2015 decided that the MRLs can be extrapolated in the group of crops, if the Good Agriculture Practices (GAP) are similar to the crop in the group on which

MRL / risk assessment has already been carried out on the basis of scientific data submitted by the applicant.

Constitution of Sub Committee on Implementation Crop Grouping Principles for Extending Label Claims

The Registration Committee in its 369th meeting held on 4th October, 2016 deliberated the implementation of crop grouping and opined that the issue needs further scientific discussion since it effects the environment and human beings directly; and constituted a sub-committee under the Chairmanship of Dr. P.K. Chakrabarty, ADG (PP), ICAR & Member RC to recommend the procedure to implement Crop Grouping principles while protecting the environment and human beings within the ambit of the Insecticides Act.

The sub-committee comprised of the following members:

1. Dr. P.K. Chakrabarty, ADG (PP &B), ICAR, Krishi Bhawan, New Delhi (Chairman)
2. Dr. K.K. Sharma, Network Coordinator, AINP on Pesticide Residues, ICAR-IARI
3. Dr. T.A. Usmani, JD(PP) -Member
4. Dr. P.S.Nain, JD(PP)- Member
5. Miss. Kamlesh Miglani, DD(Chem) -Member
6. Dr. Vashudha Gautam, AD(E) -Member
7. Dr. Subhash Kumar, DD(WS) – Member Secretary
8. Dr. Vandana Tripathy, Senior Scientist, AINP on Pesticide Residues, ICAR-IARI -Co-opted Member

Workshop on "Crop Grouping and Minor Use Concept for Crop Protection Products in India"

The issue of off-label use of pesticides in Indian agriculture was identified as a major SPS/ TBT concern in Indo-Canada joint working group where ADG (PP & B) was made the nodal person by DAC&FW to sort out the national issue of label expansion of pesticides based on the principle followed by the PMC, Canada. As an outcome, a workshop on "Crop Grouping and Minor Use Concept for Crop Protection Products in India" was jointly organized by Indian Council of Agricultural Research (ICAR) and CropLife India (CLI) on October 24-25, 2017 at NASC Complex, ICAR, New Delhi. The expert officials from Ministry of Agriculture and Farmer's Welfare, ICAR, FSSAI, CIB&RC, SAUs and international experts from USDA, Agri Food Canada and representatives of Crop Protection industry participated in the workshop.

The workshop recommended

1. To establish at the earliest guidelines for implementation of Crop Grouping principles for group MRLs;
2. Label claim expansion within the crop group/ sub-groups; to define criteria for identification of minor crops in the Indian context;
3. Adoption of bio-efficacy and residue data requirements for minor crops based on scientific rationale through data mining or extrapolation/ national monitoring data based on global practices.

The sub-committee deliberated the modalities and guidelines for implementation of Crop Grouping principles with regard to data generation and group MRLs.

Recommendations of the sub-committee for implementation of crop grouping:

1. After series of intense deliberations over several sessions, the committee improvised/ modified the existing crop grouping scheme/ list of crops including certain representative crops, in consonance with the latest Codex Crop Grouping Classification (2017) and keeping in view the crops of major relevance to India identified on the basis of their acreage and production (Reference: Pocket book of Agricultural Statistics 2017 by MoA&FW). The revised crop grouping classification is attached as **Annexure I**.

2. The committee proposed the requirement for bio-efficacy and residue data generation for representative and member crops (**Annexure II)**.

Annexure I

Representative Crop Group of Various Crop Commodity Groups

Crop Type 01 – Fruits

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Group 001 (FC)	**Citrus fruits**		
Subgroup 001A	Lemons and Limes	**Lemon**	Citron; Kaffir Lime; Lemon; Lime; Lime, Sweet; Limequats; Mexican lime, Rough Lemon
Subgroup 001B	Mandarins	Mandarins	Mandarin, Mediterranean mandarin, Willow leaf mandarin, Kinnow*
Subgroup 001C	Oranges, Sweet, Sour	Orange	Orange Sour; Orange, Sweet; Indian wild orange; Golden Lime
Subgroup 001D	Pummelos	Pummelos or Grapefruit *(Chakotara*)	Grapefruit; Pummelo; Tangelo
Group 002 (FP)	**Pome fruits**		
Subgroup002A	Pomes	Apple or pear	Apple; Crab-apple; Loquat; Medlar; Pear; Quince
Group 003 (FS)	**Stone fruits**		
Subgroup 003A	Cherry	Cherry (sweet or sour)	Cherry black; Cherry Nanking; Cherry Sour; Cherry Sweet; **Spanish cherry/ Maulsari**
Subgroup 003B	Plums	Plum	Bullace; Cherry plum; Jujube Chinese; Plum, Plum beach; Prune Plum; **Ramontchi, Governor's plum; Indian plum**
Subgroup 003C	Peaches	Peach or Apricot	Apricot; Japanese apricot; Nectarine; Peach
Group 004 (FB)	**Berries and other small**		

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
	fruits		
Subgroup 004A	Cane berries	Blackberry or Raspberry	Cane berries; Blackberries; Raspberries (Red, Black, yellow), Rose leaf bramble; *Rubus cooperi***;** *Rubus polyodontus* **Hand; Rubus quinquefoliolatus; Yellow Himalayan raspberry; West Indian raspberry; Stone bramble**
Subgroup 004B	Bush berries	Gooseberry	Gooseberry; European barberry
Subgroup 004C	Large shrub / berries	Mulberries or Phalsa	Mulberries; Phalsa;
Subgroup 004D	Small fruit vine climbing	Grapes	Grapes, Table grapes; Wine grapes
Subgroup 004E	Low growing berries	Strawberry	Strawberry; Strawberries, Wild; **Mock strawberry / Indian strawberry**
Group 005 (FT)	**Assorted tropical and sub-tropical fruits - edible peel**		
Subgroup 005A	Assorted tropical and sub-tropical fruits - edible peel – small	Olives	Almondette, Arbados cherry; Carandas-plum; Ceylon iron wood; Ceylon olive; Chinese olive, Chirauli-nut; False sandalwood; Gooseberry; Abyssinian; Ceylon; Fragant Manjack; Hog plum; Illawarra plum; Jamaica cherry; Jambolan; Java apple; Karanda; Kapundung; Otaheite gooseberry; Rumberry; Sea grape; Surinam cherry; Table olives; Black Dammar; Mootikaya
Subgroup 005B	Assorted tropical and sub-tropical fruits - edible peel – medium to large	Guava or Indian (*Ber*)	Ambarella; Bilimbi; Carambola; Carob; Cashew apple, Fig, Gooseberry Indian, Guava, Guava Brazilian; Jujube Indian (*Ber*); Mombin Malayan, Monkeyfruit; *Noni;* Pomerac; Rose apple; Sentul
Subgroup 005C	Assorted tropical and sub-tropical fruits - edible peel – palms	Date	Date; Doum or Dum palm, Jelly palm; Desert date
Group 006 (FI)	**Assorted tropical and sub-tropical fruits - inedible peel**		
Subgroup 006A	Assorted tropical and sub-tropical fruits - inedible peel – small	Litchi	Bael fruit; Litchi; Longan; Madras- thorn; Mesquite; Tamarind (sweet varieties); Wampi; Burmese grape*

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Subgroup 006B	Assorted tropical and sub-tropical fruits - inedible smooth peel - large	Mango or banana	Avocado; Banana; Cacao; *Kokam*, Langsat; Mango, Mangosteen; Papaya; Pomegranate; Sataw Tamarillo
Subgroup 006C	Assorted tropical and sub-tropical fruits - inedible rough or hairy peel - large	Pineapple or Sapota	Breadfruit; Champedak; Custard Apple; Durian; Elephant apple; Jackfruit; Monkey-bread tree; Pineapple; Rambutan; Sugar apple; Sapota (Sapodilla)
Subgroup 006D	Assorted tropical and sub-tropical fruits - inedible peel - cactus	Prickly pear	Prickly pear
Subgroup 006E	Assorted tropical and sub-tropical fruits - inedible peel - vines	Kiwifruit or Passionfruit	Granadilla Giant; Kiwifruit; Passion fruit
Subgroup 006F	Assorted tropical and sub-tropical fruits - inedible peel – Tropical palm fruits	Coconut (Tender and mature)	Coconut; Muriti; Palmyra Palm

Crop Type 02 – Vegetables

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Group 009 (VA)	**Bulb vegetables**		
Subgroup 009A	Bulb Onions	Onion	Daylilly; Garlic; Great-headed Garlic; Lily; Onion Bulb; Shallot; Silverskin onion
Subgroup 009B	Green Onions	Green (spring) onion	Leek; Pearl onion ; Spring onion
Group 010 (VB)	**Brassica vegetables**		
Subgroup 10A	Flower head Brassicas	Cauliflower	Broccoli; Cauliflower
Subgroup10B	Head Brassicas	Cabbage	Cabbages head; Brussels sprouts

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Subgroup 10C	Stem Brassicas	Kohlrabi (Knolkhol)	Kohlrabi (Knolkhol); Stem mustard
Group011 (VC)	**Fruiting vegetables, Cucurbits**		
Subgroup 11A	Fruiting vegetables, Cucurbits – Cucumbers and Summer squashes	Cucumber and gourd (Bitter gourds or bottle gourd)	Balsam apple; Bitter gourd (Bitter melon); Ridge gourd; Bottle gourd; Cucumber; Casaba or Casaba melon; Chayote;Chieh qua, Citron melon; Courgette (Zucchini) ; Cushaws (*Cucubita mixta*); Cucumber; Gac; Gherkin; West Indian Gherkin; Gourd; Bitter snake Gourd; buffalo Gourd; Malabar Gourd; Pointed Gourd; Round gourd; Ivy gourd; Loofah; Angled; Loofah Smooth; Snake gourd; Summer Squash; **Spine gourd /Kankoda /Katole**
Subgroup 11B	Fruiting vegetables, Cucurbits – Melons, Pumpkins and Winter squash	Melon (musk melon)	Cantaloupe; Casaba melon; Melons; Muskmelon; Serpent Melon (Kakri); Watermelon; Butternut squash; Cheese pumpkin; Cushaws (*Cucurbita argyrosperma*); Giant pumpkin; Hubbard squash; Indian round gourd; Pumpkins; Wax gourd; Winter squash
Group 012 (VO)	**Fruiting vegetables, other than Cucurbits**		
Subgroup 12A	Tomatoes	Tomato	Tomato; Bush tomato; Cherry tomato; Cocona; Currant tomato; Garden huckleberry; Goji berry; Ground cherries; Strawberry tomato; Sunberry; Tomatillo
Subgroup 12B	Pepper and pepper-like commodities	Okra and Chilli Pepper	Bird chili peppers; Cherry Martynia; Okra;Peppers ; Chili Peppers; Sweet peppers (Bell pepper); Long peppers; Roselle
Subgroup 12C	Eggplant and eggplant-like commodities	Eggplant (Brinjal)	Eggplant; Pea Eggplant; Pepino; Tree melon; Aubergine
Group 013 (VL)	**Leafy vegetables (including Brassica leafy vegetables)**		

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Subgroup 013A	Leafy greens	Spinach and Lettuce	African Eggplant leaves; Amaranth leaves; Aster Indian;Ayoyo; Barley shoot; Bitter leaf; Blackjack; Cat's Whiskers; Chamsuk; Chicory leaves; Chili pepper leaves; Chrysanthemum edible leaves; Common bean leaves; Cowpea leaves; Dandelion; Daylily leaves; Ebolo; Fame flower; Feather cockscomb; Glasswort common; Gomchwi; Goosefoot leaves; Jute; Lettuce bitter; Lettuce Head; Lettuce Leaf; Mallow leaves; Peanut leaves; Perilla leaves; Plantain leaves; Purslane; Purslane Winter; Sanmaneul leaves; Sowthistle; Soya bean leaves; Spinach; Spinach Indian; Violet Chinese
Subgroup 013B	Brassica Leafy vegetables	Mustard greens	Chinese cabbage (type Pak-choi); Cress Garden; Cress upland; Flowering white cabbage; Hanover salad; Kale; Kohlrabi leaves; Leaf mustard; Mustard greens; Mustard (tuberous rooted, Chinese); Purple-stem mustard; Rape greens; Radish leaves; Rucola; Turnip greens
Subgroup 013C	Leaves of root and tuber vegetables	Sweet Potato leaves or Taro (Arbi) leaves	Arrowroot leaves; Cassava leaves; Sweet potato; leaves; Taro leaves; Beet leaves (*chard*)
Subgroup 013D	Leaves of trees, shrubs and vines	Roselle leaf or Grape leaves	*Acacia* shoots; Ben moringa leaves; Grape leaves; Monkey-bread tree leaves; Papaya leaves; Roselle leave s; White lead tree
Subgroup 013E	Leafy aquatic vegetables	Kangkung (water spinach)	Kangkung; Watercress; Water mimosa
Subgroup 013 F	Witloof	Witloof chicory (sprouts)	Witloof chicory (sprouts)
Subgroup 013G	Leaves of Cucurbit crops	Pumpkin leaves	Balsam pear leaves; Chayote leaves; Ivy gourd; *Kahurura*; Pumpkin leaves
Subgroup 013H	Young leaves	Leaf lettuce or any crop intended to use as	Leaves of crops under use as commodity (these are not often traded and so need not be under consideration at present;

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
		baby leaves, (harvested up to 8 true leaf stage)	however, as and when arising, such relevant commodity can be viewed by competent agency for the purpose of fixing MRL value.
Subgroup 013 I	Sprouts	Mungbean sprouts or chickpea sprouts or soybean sprouts	Alfalfa sprouts, Mungbean sprouts, Radish sprouts, Soybean sprouts, chickpea sprouts
Group 014 (VP)	**Legume vegetables**		
Subgroup 014A	Beans with pods	French bean (Common bean)	Broad bean; Catjang; Common bean / French bean/ *Phaseolus vulgaris*; Cowpea; Goa bean; Cluster bean (*Guar)*; Jack bean; Lablab bean; Moth Mung bean; Rice bean; Scarlet runner bean; Soybean; Stink bean; Sword bean; Urd bean; Winged pea; Yard-long bean
Subgroup 014B	Peas with pods	Garden Peas or Pigeon pea (for pods and succulent immature seeds)	Garden pea; Grass pea; Lentil; Pigeon pea; Podded pea;
Subgroup 014C	Succulent beans without pods	Common bean or Cowpea or Soybean (succulent beans)	Beans without pods; Black eyed peas; broad bean (shelled); Catjang: Common bean: Cowpea: Goa bean: Jack bean: Lablab bean: Limabean: Lupin: Moth bean: Scarlet runner bean: Soybean: Stink bean: Velvet bean
Subgroup 014D	Succulent peas without pods	Garden Peas or Chickpea	Garden pea; others such as Chickpea, Lentil, Pigeon pea
Subgroup 014E,	Underground immature beans and peas	Peanut (immature)	Peanut (immature)
Group 015 (VD)	**Pulses**		
Subgroup 015A	Dry beans	Common bean and	Adzuki bean (dry); Black-eyed pea; Broad bean (dry); Butter

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
		soybean (dry)	bean; Common bean/ kidney bean/ Rajma/ *Phaseolus vulgaris* (dry); Common vetch; Cowpea (dry); Goa bean; Guar beans (dry); Horse gram; Lablab bean (dry); Lupin (dry); Moth bean(dry); Mung bean (dry); Narbon bean; Rice bean (dry);Scarlet runner bean(dry); Soya bean (dry); Swordbean (dry); Tepary bean (dry); Tick bean; Urd bean (dry); Velvet bean (dry); Winged pea (dry);
Subgroup 015B	Dry peas	Chickpea or Pigeon pea or Field pea (dry)	Peas (dry), Chick-pea (dry), Field pea(dry), Grass-pea(dry),Lentil (dry), Pigeon pea (dry)
Group 016 (VR)	**Root and tuber vegetables**		
Subgroup 016A	Root vegetables	Carrot and Radish	Beetroot; Edible Burdock greater; Caraway black root; Carrot; Celeriac; Chicory roots; Dandelion root; Ginseng; Horseradish; Kudzu; Madeira vine; Parsley; Turnip-rooted Parsley; Radish; Radish (black); Radish (Japanese); Sugar beet; Ti palm; Turnip
Subgroup 016B	Tuberous and corm vegetables	Potato	Alocasia; American potato bean; Arrowroot (Guinea); Arrowroot (Polynesian); Canna (edible); Cassava (Tapioca); Chayote root; Chinese potato; Elephant foot yam; Gastrodia tuber; Goa bean root; Potato; Sweet potato; Taro; Tiger nut; Yams; Yam bean
Subgroup 016C	Aquatic root and tuber vegetables	Water chestnut (Singhara)	Lotus tuber (*kamal-kakri*); Water chestnut, Water bamboo, Foxnut
Group 017 (VS)	**Stalk and stem vegetables**		
Subgroup 017A	Stalk and stem vegetables - Stems and Petioles	Flowering stalk of Garlic or Celery	Burdock (edible tops); Celery; Lettuce; Fennel bulb; Flowering stalk of Garlic; Sweet potato (stems); Taro stems; Zuiki; **Garlic Scapes**

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Subgroup 017B	Stalk and stem vegetables - Young shoots	Asparagus	Asparagus; Bamboo shoots; Ferns (edible)
Subgroup 017C	Stalk and stem vegetables – Others	Water celery	Palm hearts; Prickly pear pads; Water-celery
Group 018 (VF)	**Edible Fungi**	Button mushroom	Fungi Edible except Mushrooms; Button mushroom; Cep; Hirmeola; More; Net bearing Dictyophora; Oyster mushroom; Straw mushroom; Wood ears mushroom

Crop Type 03- Grasses

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Subgroup 020A	Wheat, similar grains and pseudocereals without husks	Wheat	Wheat, similar grains, and pseudocereals without husks (GC 2086): Amaranth, grain; Cañihua; Chia; Cram-cam; Huauzontle; Quinoa; Rye; Triticale; Wheat
Subgroup 020B	Barley, similar grains, and pseudocereals with husks	Barley	Barley, similar grains, and pseudocereals with husks (GC 2087): Barley; Buckwheat; Buckwheat, tartary; Oats
Subgroup 020C	Rice cereals	Rice	Rice Cereals (GC 2088): Rice; Rice, African; Wild rice
Subgroup 020D	Sorghum Grain and Millet	Sorghum Grain	Sorghum Grain and Millet (GC 2089): Hungry rice; Job's tears; Millet; Sorghum Grain; Teff or Tef;
Subgroup 020E	Maize Cereals	Maize	Maize; Popcorn; Teosinte
Subgroup 020F	Sweet corns	Sweet corn (Corn-on-the-cob) (kernels plus cob with husk removed)	Sweet corns (GC 2090): Baby corn; Sweet corn (Corn-on-the-cob) (kernels plus cob with husk removed); Sweet corn (whole kernel without cob or husk)

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Group 021 (GS)	**Grasses, for sugar or syrup production**	Sugarcane	Sugar cane, Sorgo or Sorghum (sweet),

Crop Type 04- Nuts and Seeds

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Group 022 (TN)	**Tree nuts**	Almond or walnut; and Cashew nut	Almonds; Betel nut /Arecanut; Candle nut; Cashew nut; Coconut; Hazelnuts; Japanese horse-chestnut; Java almonds; Dhuna rata; Pine nuts; Pistachio nut; Tropical almond; Walnuts, Indian or Himalayan Horse Chestnut, Dhuna Rata, Black dammar
Group 023 (SO)	**Oilseed and oil fruits**		
Subgroup 023A	Small seed oilseeds	Rapeseed or Mustard,	Rape seeds; Mustard seeds; Linseed; Mustard seed (Field/toria); Mustard seed (Indian); Perilla seed; Poppy seed; Sesame seed
Subgroup 023B	Sunflower seeds	Sunflower seeds	Jojoba seed; Niger seed; Safflower seed; Sunflower seed
Subgroup 023C	Cotton seed	Cotton seed	Cotton seed
Subgroup 023D	Other oil seeds	Peanut or Soybean seed	American oil palm seed; Argan Nut; Babassu seed; Ben Moringa seed; Castor bean; Hempseed; Kapok; Melon seed; Palm nut; Peanut; Pumpkin seed; Sea buckthorn seed; Shea nut; Soybean seed
Subgroup 023E	Oil fruits (fruits of palm trees)	Olives for oil production	American oil palm fruit; Maripa palm fruit; Olives for oil production; Palm fruit (African oil palm); Tucum fruit
Group 024 (SB)	**Seed for beverages and sweets**	Coffee bean	Coffee beans, Cocoa beans; Seeds of the sweet basil -sabja, tukmaria
Group 025	**Tree saps**	Any commodity in this subgroup	Birch sap; Hophornbeam sap; Manna sap; Maple sap; Nut sap; Palm sap; Sycamore sap;

* Peanut is only representative of peanut

Crop Type 05 – Herbs and Spices

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Group 027 (HH)	**Herbs**		
Subgroup 027A	Herbs (herbaceous plants)	Coriander leaves or Mint leaves	Anise; Basil leaves ; Indian Borage; Calendula Flowers / leaves; Cumin (Carraway) leaves; Celery leaves; Coriander leaves; Costmary; Coverfern; Cilantro leaves; Dill leaves; Fennel leaves; Fenugreek leaves; Geranium leaves; Horehound; Lavender; Lemongrass; Marigold leaves; Marjoram; Mint; Nettle; Pandan, leaves; Parsley, leaves; Pennywort; Perilla, leaves; Rosemary; Sage and related Salvia species; Savor, Summer and Winter; Common Sorrel; Southernwood; Stevia; Thyme; Wasabi Stem; Wild beetle leaf bush; Psyllium seed husk / Isabgol
Subgroup 027B	Leaves of woody plants (leaves of shrubs and trees)	Curry leaf or Cinnamon (Tejpata leaves)	Aniseed myrtle; Boldo; Curry leaf tree (*Murraya koenigii*); Eucalyptus leaves; Laurel leaves; Pepper (leaves); Pepperbush leaves; Indian bay leaf **(**Tejpata leaves) *Cinnamomum tamala*
Subgroup 027C	Edible flowers	Any commodity in this subgroup	Calendula, flowers; Courgette, flowers; Daylily, flowers; Daisy, common, flowers; Geranium, flowers; Marigold, flowers; Nasturtium, flowers; Violet, flowers; rose flowers and other edible flowers
Group 028 (HS)	**Spices**		
Subgroup 028A	Seeds	Cumin seed or Coriander seed	Carom (Ajowan) - *Ajwain*; Angelica seed; Anise seed; Basil seed; Black caraway; Caraway seed; Celery seed; Coriander seed; Cumin seed; Dill seed; Fennel seed; Fenugreek seed; Nutmeg; Parsley seed
Subgroup 028B	Fruit or Berry	Cardamom or Black Pepper	Caper berries; Cardamom (pods and seeds); Cumin black; Cardamom black; Eucalyptus fruit; Gardenia fruit; Juniper berry; Nasturtium pods; Black Pepper; Pepper (Cubeb); Pepper (Long); Pepper bush berry; Pimento (fruit); Tamarind; Vanilla beans; pink

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
			pepper; green pepper
Subgroup 028C	Bark	Cinnamon	Cassia bark; Cinnamon bark; Eucalyptus bark; Mastic; Red cinchona
Subgroup 028D	Root or rhizome	Turmeric or Ginger	Coriander (root);Ginger (rhizomes); Liquorice (roots);Turmeric (root); Asafoetida; Zedoary; ashwagandha roots
Subgroup 028E	Buds	Cloves	Caper buds; Cassia buds; Cloves (buds)
Subgroup 028F	Flower or stigma	Saffron	Saffron
Subgroup 028G	Aril	Mace (*Javitri*)	Mace
Subgroup 028H	Citrus Peel	*Kafir* lime peel	Kaffir lime peel; Lemon, peel; Orange, peel; Satsuma mandarin, peel
Subgroup 028I	Dried chili peppers	Peppers, Chili, dried	Peppers, Chili, dried

Crop code (Group/ Sub-group)	Crop group	Representative crop	Commodities
Group 029- Derived product of plant origin			
Group 029	Tea	Tea	Black, green, fermented tea

***To be included in the Codex crop grouping**

They are used mainly in a fermented and dried form or only as dried leaves for the preparation of infusions, which are used as beverages. Newly grown vegetative shoots (terminal bud and 2-3 leaves) of tea are plucked, withered, twisted and communicated and thereafter, in general, fermented and dried. Teas made from other plants are often prepared in a similar way.

Annexure II

Proposed Data generation Scheme for implementation of crop grouping for fixation of Sub group MRL

S. No.	Crop	Number of Locations(L) and Seasons (S)			MRL fixation/ value (Subgroup)
		Bio-efficacy	Residue		
			Insecticides Fungicides, Seed Treatment, Plant Growth Regulators	Herbicides	
1	**Representative Crop(s)**	3L 2S	4L 1S	3L 2S	Based on highest residue/worst case from Rep. crops subgroup MRL to be set
2	**Member commodity in same Sub Group (Dose is comparable with representative crop i.e. does not exceed the recommended dose by more than 25%)***	3L 1S	1L1S	1L1S	Sub Group MRL shall apply to member crops

* It will be applicable once FSSAI adopts the proposed guidelines for fixation of MRL at 1.25X dose.

- The bio-efficacy and residue data must be generated for the representative crop for recommendation of label claim and fixation of PHI by CIB&RC. The same recommendation will be forwarded to FSSAI for the fixation of Sub-Group MRL. However, the FSSAI shall issue notification for MRL fixation on that particular representative crop(s) only. A suitable communication mechanism between CIB&RC & FSSAI would be necessary to refer the Sub group MRLs so established. MRLs fixed based on particular commodity crop group approach has to be indicated as part of RC Minutes. It is important for reference of subsequent registrant who may seek label claim on member crop commodities.

- For other member commodities of the same sub group, bio-efficacy and residue data must be generated for those particular commodities on which the label claim is desired.

- In other words, subgroup MRL does not ensure label claim on all member commodities unless requisite bio-efficacy and residue data is generated on individual member crops. After obtaining the recommendation of Registration Committee, the FSSAI will issue notification for the Sub group MRL fixation on the member crop(s).

ANNEXURE 3.2.1

REPORT OF THE EXPERT COMMITTEE UNDER THE CHAIRMANSHIP OF DR KK SHARMA, NETWORK COORDINATOR, ICAR-AINP ON PESTICIDE RESIDUE, IARI, NEW DELHI, ON THE PERSISTENCE STUDIES IN PLANT

The Registration Committee (RC) in its 380th meeting held on 20-11-2017, while deliberating the deferred Agenda item no. 9.25 of 379th meeting of RC, constituted the following expert Committee

1. Dr KK Sharma, Network Coordinator, ICAR-AINP on Pesticide Residue, IARI, ND - Chairman
2. Dr Archana Sinha, Joint Director (Chem), DPPQS, Faridabad - Member
3. Dr Subhash Kumar, Deputy Director (WS), DPPQS - Member Secretary

The Committee co-opted the following Members in various meetings.

4. Dr VandanaTripathy, Senior Scientist, AINP on Pesticide Residue, ICAR-IARI, ND
5. Dr CS Rao, Director, Pesticide Management, NIPHM, Hyderabad;
6. Dr PG Shah, Residue Analyst, Pesticide Residue Laboratory, Anand Agriculture University, Anand
7. Dr Balwinder Singh, Consultant, MPRNL, Ex-Director Research, PAU, Ludhiana;
8. Dr JK Dubey, Professor, Dr YS Parmar University of Horticulture &Forestry, Solan 9. Dr Saudamini Mohapatra, Principal scientist, ICAR-IIHR, Bengaluru

The TOR of the Committee has been: -

(i) To suggest the Field Persistence studies in plant and their analytical test studies in plant samples, issues raised in Agenda of RC

(ii) The committee can co-opt any other expert as deemed fit for the purpose and shall submit its report within 60 days.

The following issue were raised in the 389th meeting of RC while deliberating the deferred Agenda item no.9.25 of 379th meeting: -

RC has approved various laboratories for Bio-efficacy, Persistence studies and Residue studies for the purpose of registration of pesticides. With respect to residue data, field studies are carried out in SAU and/or ICAR institutes and analytical test

studies are carried out in the RC approved laboratory (ies). However, for persistence data, many of the RC approved laboratories are carrying out field studies themselves. Therefore, requirement of guidance was sought from RC, whether, these laboratories are approved by RC to conduct Analytical test of the samples only or to carry out the field studies along with analytical test of the samples.

The committee deliberated these issues during the meetings held on 18.05.2018, 25.06.2018,10.08.2018 and 05.10.2018. The lists of participants are enclosed at **Annexure-1**.

The Committee recommends the following: -

1. For registration of pesticides, for data generation on persistence in plant; and residues in plant and soil, Field experiments should be carried out by the National Agricultural Research System (ICAR Institutes /SAUs). IPFT, Gurgaon and UPASI (for Tea only) institutes are already approved by the RC to carry out the field studies w.r.t. bio-efficacy including Residues. Any other competent public funded university having field facilities for agricultural research subjected to approval of RC.

2. All the Samples collected from field experiments should get analyzed from the laboratory(ies) of ICAR/SAU which are NABL accredited or laboratories holding GLP certification or laboratories which are RC approved, located preferably in the same region, for analytical studies of the pesticides persistence and residues. It is recommended that RC may approve only NABL accredited or GLP certified laboratory(ies) for analysis of pesticide residues.

3. The Committee developed a SOP to study the persistence and residues in plant & Soil.

4. The Expert Committee recommends that as per the critical GAP of CODEX, the residue and persistence data may be generated at recommended dose, 25 % higher than recommended dose, and control for registration purposes.

5. Accordingly, MRL may be fixed by the FSSAI based on the data generated at 25% higher than recommended dose, as per the international practice.

6. Regarding LOQ for the sensitivity of the method, the Committee recommends that the LOQ may be proposed by the applicant firm, however, final LOQ of a pesticide should be reported by the laboratory as per the acceptable recovery achieved, under intimation to applicant firm.

7. The committee observed and recommends that requirement of processing factor arises only, if residues of a pesticide are likely to be higher in the processed raw food, consumed by the public e.g. Rice, Tea, Chilies, Pepper etc.

8. The Persistence (decline study) and Residue data must be generated under Indian conditions.

9. The Committee framed & recommended the SOP consisting following guidance documents: -

   (A) Good agricultural practices for persistence and residue field studies **(Appendix-A)**

   (B) Protocol for sampling for residue and persistence analytical test studies **(Appendix-B)**

   (C) Guidelines for Persistence and Residue analytical test studies (**Appendix-C)**

10. The Committee recommends that these Guidance documents shall replace the existing Protocol for Residue Studies in the Gaitonde Committee Report of 30th November, 1978 and further amendments by RC made earlier to this report.

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Annexure-1

List of Participants in the 1st meeting of the Expert Committee held on 18-05-2018 in PC Cell at ICAR-IARI, New Delhi

1. Dr KK Sharma, Network Coordinator, AINP on Pesticide Residue, ICAR-IARI, ND
   - Chairman
2. Dr Archana Sinha, Joint Director(Chem), DPPQS, Faridabad - Member
3. Dr VandanaTripathy, Senior Scientist, AINP on Pesticide Residue, ICAR-IARI, ND
   -Co-opted member
4. Dr Subhash Kumar, Deputy Director (WS), DPPQS - Member Secretary

List of Participants of the 2ndmeeting of the Expert Committee held on 25-06-2018 in PC Cell at ICAR-IARI, New Delhi

1. Dr KK Sharma, Network Coordinator, AINP on Pesticide Residue, ICAR-IARI, ND
   - Chairman
2. Dr Archana Sinha, Joint Director(Chem), DPPQS, Faridabad - Member
3. Dr VandanaTripathy, Senior Scientist, AINP on Pesticide Residue, ICAR-IARI, ND
   -Co-opted member
4. Dr CS Rao, Director, Pesticide Management, NIPHM, Hyderabad;
   -Co-opted member
5. Dr PG Shah, Residue Analyst, Pesticide Residue Laboratory, Anand Agriculture University, Anand
   -Co-opted member
6. Dr Balwinder Singh, Consultant, MPRNL, Ex-Director Research, PAU, Ludhiana;
   -Co-opted member
7. Dr Subhash Kumar, Deputy Director (WS), DPPQS - Member Secretary

List of Participants of the 3rd meeting of the Expert Committee held on 10-08-2018 in PC Cell at ICAR-IARI, New Delhi

1. Dr KK Sharma, Network Coordinator, AINP on Pesticide Residue, ICAR-IARI, ND
   - Chairman

2. Dr VandanaTripathy, Senior Scientist, AINP on Pesticide Residue, ICAR-IARI, ND
-Co-opted member
3. Dr PG Shah, Residue Analyst, Pesticide Residue Laboratory, Anand Agriculture University, Anand -Co-opted member
4. Dr Balwinder Singh, Consultant, MPRNL, Ex-Director Research, PAU, Ludhiana;
-Co-opted member
5. Dr Subhash Kumar, Deputy Director (WS), DPPQS - Member Secretary

List of Participants of the 4th meeting of the Expert Committee held on 05-10-2018 in PC Cell at ICAR-IARI, New Delhi

1. Dr KK Sharma, Network Coordinator, AINP on Pesticide Residue, ICAR-IARI, ND
- Chairman
2. Dr Archana Sinha, Joint Director(Chem), DPPQS, Faridabad - Member

3. Dr VandanaTripathy, Senior Scientist, AINP on Pesticide Residue, ICAR-IARI, ND
-Co-opted member
4. Dr PG Shah, Residue Analyst, Pesticide Residue Laboratory, Anand Agriculture University, Anand -Co-opted member
5. Dr Balwinder Singh, Consultant, MPRNL, Ex-Director Research, PAU, Ludhiana;
-Co-opted member
6. Dr JK Dubey, Professor, Dr YS Parmar University of Horticulture &Forestry, Solan
-Co-opted member
7. Dr Saudamini Mohapatra, Principal scientist, ICAR-IIHR, Bengaluru
-Co-opted member
8. Dr Subhash Kumar, Deputy Director (WS), DPPQS - Member Secretary

Appendix-A

(A) GOOD AGRICULTURAL PRACTICES (GAP) FOR PERSISTENCE AND RESIDUE FIELD STUDIES

Good Agricultural Practices (GAP) are on-farm and post-harvest practices to be followed by farmers at farm level for safe and healthy food production. The components of GAP include principles and practices to be followed from seed including soil management, water management, agronomic practices etc., and finally food intended for human consumption. The GAP of DAC&FW /ICAR / SAU can be followed for conducting the trials.

The ever increasing population in India requires more food to feed the nation, and in addition to food security, the safe food production plays very vital role for human safety as modern agriculture utilize agro-chemicals for harvesting high crop yields. This can be achieved by the judicious and scientific application of pesticides to manage the target pests on crops and also to meet the food safety standards.

Pesticides are one of the most important agricultural input for crop protection, which is of concern for food safety. Supervised trials for residue studies should be conducted as per the pesticide recommendations / approved uses as per the Insecticide Act, 1968. The pesticides in GAP include nationally recommended dosages against target pest on specific crop, time of application and method of application under actual conditions necessary for effective pest control and to observe the pre-harvest interval (PHI). Approved uses of pesticides vary from country to country in a particular crop against target pest, and in some cases, vary from region to region. The use of pesticides in GAP should be within the range and level of highest authorized use, and authorized safe use at national level which not only include use on crops but also in any stage of storage, transport, distribution and processing of food commodities.

Supervised field trials in crops are conducted to determine pesticide residue levels in or on raw agricultural commodities, including feed items, and should be designed to reflect pesticide use patterns that lead to the highest possible residues according to GAP. On the basis of the supervised field trials, the Supervised Trials Median

Residue (STMR), Highest Residue (HR) and the Maximum Residue Limit (MRL) are estimated. All three residue estimates are used in dietary risk assessment, while the MRL is also used for monitoring whether the pesticide is used in compliance with the label (i.e. with GAP). The selection of supervised trials, which correspond to the critical GAP (*c*GAP) and suitable for estimation of MRL, STMR and HR values, is one of the most important phases of the evaluation of pesticide residues. The critical GAP refers to the worst scenario where there is a possibility of deviation from the recommended GAP, for example, application of pesticides at higher doses based on the geographical situations, crop canopy and pest incidence. In case of residue studies, it is desired to take up the studies at both recommended and 25 % higher than the recommended doses for pesticide applications for desired aim to achieve the food safety, through risk analysis at highest dose applications. The critical GAP is the set of current registered (or proposed) uses involving the highest rates and shortest PHIs for the same pesticide on the same crop. The use patterns in the supervised field trials should reflect this critical GAP.

The Indian Good Agricultural Practices (INDGAP) document (http://qcin.org/documents/ GAP/INDIAGAP-FINAL.pdf) can be referred in addition to DAC&FW /ICAR / SAU package of Practices for conducting supervised field trials in India wherein critical GAP can be considered as 25 % higher than recommended application dose.

FIELD TRIAL PARAMETERS:

Number of trials:

Prior to planning of the field trials for residue studies, the required number of field trials and number of locations are decided to obtain sufficient data for requisite statistical analysis. The number of field trials and samples is dependent on the variability of pesticide use conditions, geographical distribution, the consequent variation of the residue data, and importance of the commodity in terms of production, trade and dietary consumption.

Field trials should be conducted in agro-ecological and geographical regions where the crops are predominantly grown commercially and should reflect the main types of

crop production practices, which can significantly impact residues, for example, furrow and sprinkler irrigation, pruning of grape leaves. Similarly, in case of soil applied pesticides, since soil type influence the pesticide dynamics, the field trials should include field sites with different soil types.

Presently, as per requirements of the Central Insecticide Board and Registration Committee (CIB&RC) for residue data generation in/on a crop, trials in four locations in one season has to be conducted for residue studies of insecticides and fungicides, while in case of herbicides, residue data from three locations for two seasons is required. In general, the number of trials for any crop is 4 to 6.

For stored products (e.g., potatoes, grains, seeds, fruits), post-harvest treatment should be carried out in a number of storage locations with variable conditions such as temperature, humidity, storage method (stacks/boxes) etc., provided the product use is not intended for stored products in controlled environmental conditions.

Plot Size:

The plot size may vary from crop to crop, but it should be large enough to allow application of test pesticide simulating use by farmers in general and provide sufficient representative sample. Each plot size should be minimum 20 m^2 for row crops, 4 trees for orchard crops and 8 vines for vineyard crops. Control plot should be in the immediate vicinity of the treated plots and utmost care should be taken to avoid contamination / spray drift. For this purpose adequate buffer zones be left in between adjacent plots. The number of plots (replications) for each treatment in each location has to be at least three.

Crop Variety:

The pesticide behavior varies from variety to variety of the same crop, based on various morphological and physiological characters such as hairiness, smoothness, surface texture, crop canopy, erectness, early ripening, late maturity etc., which may have impact on uptake and degradation of pesticide and their metabolites. The pesticide behavior on the same crop changes in different seasons. It is not possible to conduct trials on all varieties / hybrids of the same crop, however, most popular,

highly preferred and consumed variety during high production season should be considered for residue trials.

Location:

The field trials should be conducted in different agro-climatic zones, where the crops are predominantly grown commercially following the GAP.

Other field operations:

While conducting the field trial, the general agricultural practices such as inter-cultivation, irrigation, fertilizer application, weeding, pruning *etc.* shall be followed as per the recommended practices, so that residue dynamics will not alter, and such operations shall be performed in the same manner in all plots and trials.

Pesticide applications:

The application of pesticides using approved application equipments or commonly used sprayer ensures that the spray solution is equally spread across the field and simulates the commercial field application of a farmer's field.

The spray solution should be prepared fresh as per the recommended guidelines. Sufficient spray solution should be used to cover the entire field so as to reach the target site / pest, and necessary care must be taken by the person, who is spraying to ensure safety. The pesticide application should not be made in strong wind, during rain or when rainfall is expected shortly after application.

The dose of pesticide, number of application and spray solution concentration should be as per approved use of pesticide as per Insecticide Act, 1968, and however, in all trials, it is desired to conduct trials with minimum three treatments *viz*. control, recommended dose, and 25% higher than the recommended dose with three or more replications (*c*GAP).

Appendix-B

(B) PROTOCOL FOR SAMPLING FOR PERSISTENCE AND RESIDUE ANALYTICAL TEST STUDIES

1. General Recommendations

The best information about the residue behavior of the pesticide under study would be obtained by the analysis of the entire yield of a plot. Since this is not practicable, representative samples have to be taken. Careful attention to the details of sampling is essential if worthwhile samples are to be obtained. Valid analytical results can only be obtained if the samples have been properly taken, dispatched and stored before analysis.

In selecting sampling points and/or the sampling method, all factors that control the residue distribution over the entire experimental plot must be considered. The best approach for any given plot can only be determined by a sufficiently trained person who is capable of recognizing the importance and usefulness of the residue data sought, and who can interpret the results.

The samples must be representative to enable the analytical result to be applied to the entire experimental unit. The greater the number of plants sampled in a field plot, the more representative the sample will be. However, economics and the practical problems involved in handling large samples affect the magnitude of the sampling programme. The size of sample suggested is the minimum that experience has shown is needed to give a representative, valid sample. The sizes are not usually dictated by the analytical method, which can often determine minute amounts of pesticides in small amounts of sample.

1.1 Method of Sampling

Generally, the selection of the portions that make up the field sample should be made depending on the circumstances:

- randomly, e.g. by the use of random numbers
- systematically, e.g. in the case of field crops on a diagonal ("X" or an "S" course)
- selectively from predetermined sampling-points, e.g. in the case of tree fruits, take both exposed samples and those covered by foliage so that each fruit has an equal chance of being taken.

Points to be borne in mind are:

- Avoid taking samples at the beginning or at the extreme end of plots (start and finish of spraying).

- Take and bag the required weight or number of samples in the field and do not subsample until the samples are in a clean field laboratory or in the analytical laboratory.
- Sample all parts of the crop that can be consumed by humans or livestock.
- Sample the parts of the crop that normally constitute the commercial commodity are described.
- Where appropriate, consider commercial harvesting practice which reflects normal "Good Agricultural Practice".

1.2 Replication

In certain cases where there is likely to be considerable within-plot variation, such as orchard and glasshouse trials, three sample replicates per plot may be taken at or near harvest. Sample integrity should be maintained throughout the procedure.

The Study Plan should prescribe when replicate samples are needed. Replicate samples should be clearly indicated in the sampling and analytical reports.

1.3 Sample Handling

- Take care not to remove surface residues during handling, packing or preparation.
- Avoid any damage to or deterioration of the sample which might affect residue levels.
- To provide a representative sample of the raw commodity, adhering soil may have to be removed from some crops, such as root crops. This may be done by brushing and, if necessary, gentle quick rinsing with cold running water.
- Sample control plots before treated plots.

2. Contamination

It is vital to avoid any contamination with the pesticide under study or with other chemicals during sampling, transportation or subsequent operations. Special attention should, therefore, be paid to the following:

- Ensure that sampling tools and bags are clean. To avoid contamination use new bags and containers of suitable size and adequate strength. The bags or containers should be made of materials which will not interfere with the analysis.
- Avoid contamination of the sample by hands and clothes which may have been in contact with pesticides.
- Do not allow the samples to come into contact with containers or equipment (including vehicles) that have been used for transporting or storing pesticides.
- Avoid sampling at the plot borders because the residue deposit may not be representative.
- Take special care to avoid contamination when commercial mechanical harvesting practices are used.
- Avoid cross-contamination of crop and soil samples.

- Sampling should proceed from the control to the lowest treatment and so on to the highest treatment.

The possibility of spray drift or overlap, especially where the plot is small and particularly when various pesticides and dosages are applied to adjacent areas should be considered and avoided when the experimental plots are marked.

3. Control Samples

Control samples are in every way as important as samples from test plots. The quality of control samples should be similar to that of the test samples, e.g. maturity of fruit, type of foliage, etc.

Always take control samples. In decline studies of up to 14 days' duration, control samples from the start and from the end of the study may suffice.

4. Sampling in Decline (Dissipation) Studies and at Normal Harvest Time

Representative and valid sampling protocols might be different for decline studies and residue trials at normal harvest time.

4.1 Sampling in Decline (Dissipation) Studies

The first sampling may take place on the day of application. These samples have to be taken immediately after application or, in the case of spray application, immediately after the spray has dried (approx. 2 hours).

- Take great care to avoid contamination.
- Take samples so as to be representative of the average size or weight of crop on the plot.

4.2 Sampling at Normal Harvest Time

- Take samples so as to be representative of typical harvesting practice.
- Avoid taking diseased or undersized crop parts or commodities at a stage when they would not normally be harvested.

4.3 Detailed Sampling Procedures

The following recommendations refer to the sampling for persistence and residue studies. unless otherwise stated.

4.3.1 Fruits and Tree Nuts

- Circle each tree or bush and select fruit from all segments of the tree or plant, high and low, exposed and protected by foliage. For small fruits grown in a row, select fruit from both sides, but not within 1 meter of the end of the row.
- Select the quantity of the fruit according to its density on the tree or plant, i.e. take more from the heavily-laden parts.

- Take both large and small fruits where appropriate, but not so small or damaged that they could not be sold (except when taking immature samples for a residue decline study).
- Take samples of fruit juices, cider and wine in a manner reflecting common practice.

Table1: Sampling of fruits

Commodity	Quantity, method of collection
Citrus fruits e.g. orange, lemon, mandarin, pomelo, grapefruit, clementine, tangelo, tangerine	12 fruits from several places on 4 individual trees. (If this produces a sample weight of less than 2 kg, more fruit should be taken to yield a 2 kg sample)
Pome fruits e.g. apples, pears, quinces, medlars	
Large stone fruit e.g. apricots, nectarines, peaches, plums	
Miscellaneous fruit e.g. avocados, guavas, mangoes, papayas, pomegranates, persimmons, kiwifruit, litchi	
Small stone fruit e.g. cherries	1 kg from several places on 4 trees
Grapes	12 bunches, or parts of 12 bunches, from separate vines to give at least 1 kg
Currants, raspberries and other small berries	0.5 kg from 12 separate areas or bushes
Strawberries, Gooseberries	1 kg from 12 separate areas or bushes
Miscellaneous small fruits e.g. olives, dates, figs	1 kg from several places on 4 trees
Pineapples	12 fruits
Bananas	24 fruits. Take two fingers each from top, middle and lowest hand of four harvestable bunches
Tree nuts e.g. walnuts, chestnuts, almonds	1 kg
Coconut	12 nuts
Fruit juices, wine, cider	1 litre

4.3.2 Vegetables

4.3.2.1 Bulb vegetables, root vegetables, tuber vegetables:

- Take samples from all over the plot, excluding 1 meter at the edges of the plot and the ends of the rows. The number of sampling points depends on the sample size of the crop (see below).
- To provide a representative sample of the raw commodity, adhering soil may have to be removed. This may be done by brushing and, if necessary, gentle rinsing with cold running water.
- Trim off tops according to local agricultural practice. Details of any trimming should be recorded. Where the tops are not used as animal feed (carrots, potatoes) they should be discarded; otherwise (e.g. turnips, beets) they should be bagged separately.

Table 2 : Sampling of bulb, root and tuber vegetables

Commodity	Quantity, method of collection
Fodder beets, Sugar beets	12 plants
Potatoes	12 tubers (the sample should weigh at least 2 kg - where necessary, take a larger number to produce a 2 kg sample). For decline study take 1 Kg of sample
Other root crops e.g. carrots, red beet, Jerusalem artichoke, sweet potato, celeriac, turnip, swede, parsnip, horseradish, salsify, chicory, radish, scorzonera	12 roots (the sample should weigh at least 2 kg - where necessary, take a larger number to produce a 2 kg sample)
Leeks, Bulb onions	12 plants
Spring onions	24 plants (the sample should weigh at least 1 kg - where necessary, take a larger number to produce a 2 kg sample)
Garlic, Shallots	12 bulbs from 12 plants, (the sample should weigh at least 1 kg - where necessary, take a larger number to produce a 1 kg sample)

4.3.2.2 Brassica vegetables, leafy vegetables, stalk and stem vegetables, legume vegetables and fruiting vegetables:

- Take the sample from all parts of the plot, leaving 1 meter at the edges and ends of rows. The number of sampling points depends on the sample size of the crop (see below).
- Sample items of crops such as peas or beans protected from the spray by foliage and also from parts exposed to the spray.
- To provide a representative sample of the raw commodity, adhering soil may have to be removed. This may be done by brushing and, if necessary, gentle rinsing with cold running water.
- Do not trim except for the removal of obviously decomposed or withered leaves. Details of any trimming should be recorded.

The quantities to be taken are shown in Table 3.

4.3.3 Grasses

4.3.3.1 Cereals

- If the plot is small, cut the whole yield.
- If the plot is large but mechanical harvesting is not carried out, cut not less than twelve short lengths of row chosen from all over the plot. Cut stalks 15 cm above the ground and remove the grain from the straw.
- Care should be taken to avoid contamination when mechanical methods are used to separate the parts of the crop. The operation is best carried out in the laboratory.
- If the plots are harvested mechanically, take not less than twelve grab samples of grain and/or straw from the harvester at uniform intervals over the plot.
- Do not sample within 1 meter of the edges of the plot.

The quantities to be taken are shown in Table 4.

4.3.3.2 Grasses, forage and animal feed:

- Cut with shears at normal harvest height (usually 5 cm above the ground) the vegetation from not less than twelve areas uniformly spaced over the entire plot, leaving 1 meter at the edges of the plot.
- Record height of cutting and avoid soil contamination.
- Crops which are harvested mechanically can be sampled from the harvester as it proceeds through the crop.

The quantities to be taken are shown in Table 5.

4.3.3.3 Sugar cane

Select 5 whole canes at maturity stage from the plot and take short (e.g. 20 cm) sections from all parts of the length of the canes. For cane juice samples, care is necessary owing to the rapid changes which normally occur in cane juices. If required, 1 liter samples of juice should be taken and frozen immediately and then shipped in cans.

Table 3. Sampling of other vegetables

Commodity	Quantity, method of collection
Large Brassica crops e.g. cabbage, cauliflower, kohlrabi	12 plants

Broccoli	1 kg from 12 plants
Brussels sprouts	1 kg from 12 plants. Buttons to be taken from at least two levels on each plant.
Cucumbers	12 fruits from 12 separate plants
Gherkins, courgettes, squash	12 fruits from 12 plants (the sample should weigh at least 2 kg - where necessary take a larger number of fruit to produce a 2 kg sample)
Melons, gourds, pumpkins, watermelons[g]	12 fruits from 12 separate plants
Egg plants (aubergines)	12 fruits from 12 separate plants
Sweet corn	12 ears (the sample should weigh at least 2 kg -where necessary take a larger number of items to produce a 2 kg sample.)
Mushrooms	12 items (the sample should weigh at least 0.5 kg -where necessary take a larger number of items to produce a 0.5 kg sample)
Tomatoes, Peppers	24 fruits from small-fruiting varieties, 12 from large fruiting varieties. From 12 plants in all cases. (The sample should weigh a minimum of 2 kg - where necessary take a larger number of items to produce a 2 kg sample.)
Endive[a]	12 plants
Lettuce[a]	12 plants
Spinach[a], Chicory leaves[a]	1 kg from 12 plants
Kale	2 kg from 12 plants sampled from two levels on the plant
Small-leaf salad crops e.g. cress, dandelion, corn salad	0.5 kg from 12 plants (or sites in plot)
Peas, Phaseolus beans e.g. French, kidney, runner	1 kg (fresh green or dry seed as appropriate)
Pulses e.g. dried broad beans, field beans, lentils, soya beans	1 kg
Celery	12 plants
Asparagus, Rhubarb	12 sticks from 12 separate plants.(the sample should weigh a minimum of 2 kg where necessary take a larger number of sticks to produce a 2 kg sample)
Globe artichoke	12 heads
Fodder crops	2 kg from 12 separate areas of plot. (Crops harvested mechanically can be sampled from the harvester as it proceeds through the crop.)
Oilseed e.g. rape seed, mustard seed, poppy	0.5 kg from 12 plants (or sites in plot)

seed	

Note: (a) also at immature stages during decline studies

In case of large crops, a sample consisting of 12 units could be 50-100 kg or more. In such cases the sample size may be reduced to 5 units.

Table 4: Sampling of cereals

Commodity	Quantity, method of collection
Cereal grains e.g. wheat, barley, oats, rye, triticale and other small grain cereals; maize (off the cob), rice, sorghum	1 kg
Straw of the above crops	0.5 kg
Maize straw, fodder and forage (mature plants excluding cobs)	12 plants. (Cut each stem into three equal lengths (with leaves attached). Take top portion from stems 1 to 4, middle portion from stems 5 to 8 and bottom portion from stems 9 to 12, thus ensuring that parts of all 12 stems are included in the sample.)
Green or silage maize	12 plants. (Cut each stem and subsample as in previous item, retaining any cobs present on the appropriate portions of stem.)
Maize cobs	12 ears. (The sample should weigh at least 2 kg - where necessary, take a larger number of ears to produce a 2 kg sample.)

Table 5 : Sampling of forage crops and animal feed

Commodity	Quantity, method of collection
Green forage/silage crops of alfalfa, clover, pea and bean forage, vetch, sainfoin, lotus, soybean fodder and forage, rye forage, fodder cereals, sorghum forage	1 kg
Dry hay of the above crops	0.5 kg

4.3.4 Seeds

Use essentially the same technique as for cereals, taking samples of mature seed from at least twelve parts of the plot. Where the sample is harvested by hand, seed should normally be sent to the laboratory in the pod. Where mechanical harvesting is used, only the seed should normally be supplied.

Cotton seed:

- Pick the cotton at the normal stage of harvesting. Take 1 kg, with or without fibre.

Peanuts:

- Collect at the normal stage of harvesting. Take 1 kg.

Sesame seed, rape seed:

- Collect the pods when they have reached the stage of maturity at which they are normally harvested. Take 0.5 kg.

Sunflower seed, safflower seed:

- Where the sampling is done by hand select ripe heads. Where it is done mechanically submit the seed to the laboratory. Take 12 heads or 1 kg of seed.

Coffee and cacao beans:

- Take samples in a manner reflecting common practice, quantity 1 kg. - The freshly harvested produce is not normally required.

4.3.5 Herbs and Spices; Tea Leaves; Hops; Beer

- Take samples in a manner reflecting common practice.
- The freshly harvested produce is not normally required for tea although herbs, such as parsley and chives, should be sampled fresh. In the case of hops, both fresh and dried cones should be supplied.

Table 6: Sampling of Herbs and Spices; Tea Leaves; Hops and Beer

Commodity	Quantity, method of collection
Garden herbs and medicinal plants e.g. parsley, thyme	0.5 kg fresh 0.2 kg dry
Teas (dry leaves)	0.2 kg
Hops (dry cones)	0.5 kg
Beer	1 litre

5. Sampling processed commodities

Where a commodity is normally processed between harvest and marketing, for example by milling, pressing, fermentation, drying or extraction, data may be required on the processed crop or its products. Details of the processing method should be supplied with the samples together with storage and handling histories. In

such cases, the trials should be designed to provide samples with appropriate residue levels so that the fate of residues can be studied during the processing. Sample separately any cleanings, husks or by-products which could be used for animal feed.

6. Sampling stored commodities

Supervised trials of post-harvest treatments of stored products should be carried out over a wide range of storage facilities, and the sampling technique must be carefully chosen if valid samples are to be obtained. Procedures for taking valid samples from most commodities in storage units are well established. Such procedures are acceptable in sampling for pesticide residue analysis and may be used if adequate references are given.

The sampling procedures are usually designed for three kinds of storage conditions.

6.1 Sampling from bulk

Obtaining a representative sample from a (large) bulk container (e.g. of cereal grains) is difficult: if possible, samples should be taken at frequent intervals from the stream during transfer into another container. A probe sample is not representative but may be acceptable if:

- it is possible to reach every part of the storage container; and
- a larger number of individual samples are taken before mixing and reducing to produce a final sample.

Pesticide residues are normally higher in the dust fraction and this should be recognised in the sampling procedure.

6.2 Sampling bagged commodities

Sampling of the commodity within a bag must be random. A representative sample from a large stack of bags can be obtained only if every bag is accessible. This is not always possible in practice and the alternative is to obtain a sample from a number of randomly chosen bags by probing. Since pesticide treatments are often directed to the surface of the bag, selective sampling to show the effect of the position of the bag in the stack and the penetration of the pesticide into the bag may be necessary.

6.3 Sampling fruit and vegetables in packing houses

Where post-harvest treatments are applied to fruit and vegetables in packing houses, an adequate number of samples must be taken to determine the range of residue levels resulting from variations in the treatment process. The effects on residue levels of concentration, temperature, duration of treatment, drying (after dip treatments) and subsequent handling may need to be considered.

Post-harvest treated fruit and vegetables should be kept in, or packed in, commercial containers or punnets and stored at ambient or cool-room temperature according to normal commercial practice. Samples should then be drawn for analysis from the

commercial containers at suitable intervals representing the time expected between treatment and subsequent marketing. The rate of disappearance or degradation of some residues depends on whether the commodity is held in a sealed or partly sealed container or is open to the air.

The size of samples are the same as shown in Tables 1 - 3.

7. Sample size reduction

Large samples cannot be handled economically, especially if freezing and long transport are involved. Take only that amount prescribed in the Study Plan.

Except cereal grains sampled on the conveyor belt or from the stream of material transferred from one large container to another, mixing of samples and sample size reduction at the field site is not recommended and should be avoided.

8. Sample packing and storage

Once packed and labelled, samples may be stored or immediately sent to the Residue Laboratory according to the nature of the sample, the stability of the residue and the kind of study undertaken.

It is important that packing and shipment are carried out in such a way that the samples arrive as soon as possible (normally within 24-36 hours) after being taken and without change of any kind, e.g. deterioration, physical damage, contamination, loss of residue, or change in moisture content.

Storage and shipping should always be under deep-frozen conditions.

8.1 Packing

8.1.1 Containers

Individual samples should be placed in suitable containers, e.g. heavy polyethylene bags, and then put inside additional heavy paper bags and, where necessary, frozen or refrigerated as soon as possible after sampling according to the nature of the chemical involved. Polyethylene bags alone may become brittle in contact with dry ice and therefore there is a risk of breakage and subsequent loss of the sample.

Avoid other plastic containers, or plastic-lined caps, unless made of "Teflon" or other inert plastic which does not interfere with the analytical method; laboratories have frequently experienced such interference, and PVC bags should be avoided. If cans are used, they should first be checked to demonstrate the absence of materials such as oil films, lacquers or resin from soldered joints that could interfere with analyses.

Glass containers should be used for liquid samples and should be thoroughly cleaned and rinsed with one or more suitable pesticide-free solvent such as acetone, isopropyl alcohol or hexane, and dried before use. Pesticides can migrate to the walls of a container and be adsorbed; hence even a glass container, after the

sample is poured out, should be rinsed with solvent if the extraction is not made in the container itself.

In summary, any type of container or wrapping material should be checked before use for possible interference with the analytical method and at the limit of determination of the analysis.

Fasten boxes securely with strong twine, rope or tape.

8.1.2 Shipment of samples

Non-perishable commodities containing residues that are known to be stable over the period required to reach the laboratory can be shipped in a non-frozen state, but samples should be protected against any effects which might cause degradation or contamination.

Where samples need to be frozen, use shipping containers of polystyrene foam, if available, as they are excellent for this purpose. If not available, use two cardboard boxes of slightly different size with insulation between. Proper insulation is essential to ensure samples arrive at the residue laboratory still frozen. Sufficient dry ice must be used for some to remain when samples are received at the residue laboratory. This usually requires a minimum of one kg of dry ice per kg of sample. For journeys lasting more than two days, two kg of dry ice or more per kg of sample may be required. Poorly insulated containers require more dry ice. Use caution in handling dry ice (gloves and ventilated work area). Packages must of course comply with transport regulations.

Frozen samples must never be allowed to thaw, either before or during shipment. They must be shipped under conditions that permit their arrival at the residue laboratory still solidly frozen.

Advise the consignee by telegram or telex of the full details of shipment of samples, including shipping document numbers and flight numbers, so that delay in delivery to the laboratory is avoided.

When samples have to be shipped across national boundaries, quarantine regulations must be observed and appropriate permits obtained well in advance of dispatching samples.

8.2 Labels and records

Label each sample with the appropriate sample identification. The label and ink should be such that the writing will not be illegible if the label becomes wet. Attach the label securely so that it cannot come loose during shipment, and place the label so that it will not become wet from condensation.

Complete the Sampling Report (residue data sheets) clearly and accurately with all the requested trial details. Failure to do so may mean that data will not be acceptable. The completed sheets should be protected by enclosing them in

protective polythene bags which should be sent with the sample. Duplicate sheets should be kept by the sender.

Use a label on the outside of the shipping container stating the following:

"Perishable Goods: Deliver immediately upon arrival" and 'This material is not fit for human consumption".

8.3 Sample reception and handling

Immediately upon arrival of the samples, the Residue Laboratory personnel should:

- Verify that the copy of the Sampling Report is included with the samples.

- Check and report on the condition of the samples.

- Check to see that the samples match the details of the Sampling Report.

- Check the Sampling Report for accuracy (especially the rate and interval data) and verify that the information is complete.

- Check the Sampling Report to determine whether any special treatment or testing is indicated.

If there are any deviations of any consequence, or the Sampling Report is not received or is incomplete (in such a way that a proper comparison is not possible), the samples should be stored in the simplest form that will preserve the residue and the crop. The trial organizer should then be contacted immediately to determine how to proceed.

Note: it is dangerous to put packages containing dry ice into deep freeze.

8.4 Storage

Samples should be analysed as quickly as possible after collection before physical and chemical changes occur. If prolonged storage is unavoidable, it is usually preferable to store the samples at a low temperature, preferably at or below -20°C. This removes the residue from contact with enzymes which might degrade the pesticide and also prevents further possibility of residues being "bound" in the tissue. Do not store samples (whole or homogenized) for analysis unless an adequate check has been made on the stability of the residue. Fumigant residue samples need special attention and ideally should be analysed immediately on receipt at the laboratory. Storage at -20°C is likely to be inadequate to prevent loss of fumigant residues.

Studies of the stability of residues in samples, over the time and at the temperature of storage, should be carried out with representative pesticides and substrates. When there is doubt about the stability of residues in storage, spiked control samples should be held under the same conditions as the samples or extracts.

Light degrades many pesticides; it is therefore advisable to protect the sample and any solutions or extracts from needless exposure. Samples other than water should ordinarily be stored in a freezer, preferably at -20°C or below. Even then, physical and chemical changes may occur either in the sample or in the residues sought. Extended storage in freezers can cause moisture to migrate to the surface of the sample then to the freezer coils, slowly desiccating the sample. This effect may be of importance if water content affects the subsequent analysis and can affect the calculated residue concentration. Water samples should be stored slightly above freezing to avoid rupture of the container as a result of freezing.

PORTION OF COMMODITIES TO WHICH MAXIMUM RESIDUE LIMITS APPLY AND WHICH IS ANALYSED

INTRODUCTION

Maximum Residue Limits are in most cases stated in terms of a specific whole raw agricultural commodity as it moves in international trade. In some instances, a qualification is included that describes the part of the raw agricultural commodity to which the maximum residue limit applies, for example, almonds on a shell-free basis and beans without pods. In other instances, such qualifications are not provided. Therefore, unless otherwise specified, the portion of the raw agricultural commodity to which the MRL applies and which is to be prepared as the analytical sample for the determination of pesticide residues is as described in the following table.

<table>
<tr><th colspan="2">CLASSIFICATION OF COMMODITIES</th><th>PORTION OF COMMODITY TO WHICH THE MRL APPLIES (AND WHICH Is ANALYSED)</th></tr>
<tr><td colspan="3">ROOT AND TUBER VEGETABLES</td></tr>
<tr><td colspan="2">Root and tuber vegetables are starchy foods derived from the enlarged solid roots, tubers, corms or rhizomes, mostly subterranean, of various species of plants. The entire vegetable may be consumed.</td><td></td></tr>
<tr><td colspan="2"><u>Root and Tuber vegetables:</u></td><td rowspan="2">Whole commodity after removing tops. Wash the roots or tubers in cold running water, brushing gently with a soft brush to remove loose soil and debris, if necessary, and then dab lightly with clean tissue paper to dry. For carrots, after drying the tops are carefully cut off with a knife by cutting through the bottom of the stem at the lowest point of attachment of the outer petioles. If an annulus of root tissue</td></tr>
<tr><td>Beets
carrots
celeriac
parsnips
potatoes
radishes</td><td>rutabagas
sugar beets
sweet potatoes
turnips
yams</td></tr>
</table>

<table>
<tr><td colspan="2"></td><td>is thereby severed from hollow-crown roots, the material should be re-combined with the roots.</td></tr>
<tr><td colspan="3">BULB VEGETABLES</td></tr>
<tr><td colspan="2">Bulb vegetables are pungent, flavorful foods derived from the fleshy scale bulbs or growth buds of alliums of the lily family (Liliaceae). The entire bulb may be consumed following removal of the parchment-like skin.</td><td>Remove adhering soil (e.g. by rinsing in running water or by gentle brushing of the dry commodity)</td></tr>
<tr><td colspan="2"><u>Bulb vegetables:</u></td><td rowspan="2">Bulb/dry onions and garlic: Whole commodity after removal of roots and whatever parchment skin is easily detached. Leeks and spring onions: Whole vegetable after removal of roots and adhering soil.</td></tr>
<tr><td>garlic
leeks</td><td>onions
spring onions</td></tr>
<tr><td colspan="3">LEAFY VEGETABLES (EXCEPT BRASSICA VEGETABLES)</td></tr>
<tr><td colspan="2">Leafy vegetables (except Group 4 vegetables) are foods derived from the leaves of a wide variety of edible plants including leafy parts of Group 1 vegetables. The entire leaf may be consumed. Leafy vegetables of the brassica family are grouped separately.</td><td></td></tr>
<tr><td colspan="2"><u>Leafy vegetables:</u></td><td rowspan="2">Whole commodity after removal of obviously decomposed or withered leaves.</td></tr>
<tr><td>beet leaves
corn salad
endive
lettuce</td><td>radish leaves
spinach
sugar beet leaves
Swiss chard</td></tr>
<tr><td colspan="3">BRASSICA (COLE) LEAFY VEGETABLES</td></tr>
<tr><td colspan="2">Brassica (Cole) leafy vegetables are foods derived from the leafy parts, stems and immature inflorescences of plants commonly known and botanically classified as brassicas and also known as Cole vegetables. The entire vegetable may be consumed.</td><td></td></tr>
<tr><td colspan="2"><u>Brassica leafy vegetables:</u></td><td rowspan="2">Whole commodity after removal of obviously decomposed or withered leaves. For cauliflower and headed broccoli analyze flower head and stems, discarding leaves; for Brussels sprouts analyze "buttons" only.</td></tr>
<tr><td>broccoli
Brussels sprouts
cabbage
cabbage, Chinese
cabbage, red
cabbage, Savoy</td><td>cauliflower
collards
kales
kohlrabi
mustard greens</td></tr>
<tr><td colspan="3">STEM VEGETABLES</td></tr>
<tr><td colspan="2">Stem vegetables are foods derived from the edible stems or shoots of a variety of plants.</td><td></td></tr>
<tr><td colspan="2"><u>Stem vegetables:</u></td><td>Whole commodity after removal of</td></tr>
</table>

artichoke celery	chicory (witloof) rhubarb	obviously decomposed or withered leaves. Rhubarb and asparagus: stems only. Celery and asparagus: remove adhering soil (e.g. by rinsing in running water or by gentle brushing of the dry commodity).
LEGUME VEGETABLES		
Legume vegetables are derived from the dried or succulent seeds and immature pods or leguminous plants commonly known as beans and peas. Succulent forms may be consumed as whole pods or as the shelled product.		
Legume vegetables:		Whole commodity.
beans broad beans dwarf beans French beans green beans kidney beans Lima beans	navy beans runner beans snap beans soybeans peas cow peas sugar peas	
FRUITING VEGETABLES - EDIBLE PEEL		
Fruiting vegetables - edible peel are derived from the immature or mature fruits of various plants, usually annual vines or bushes. The entire fruiting vegetables may be consumed.		
Fruiting vegetables - edible peel:		Whole commodity after removal of stems.
cucumber egg plant gherkin okra	pepper summer squash tomato mushroom[11]	
FRUITING VEGETABLES - INEDIBLE PEEL		
Fruiting vegetables - inedible peel:		Whole commodity after removal of stems.
cantaloupe melon pumpkin	squash watermelon winter squash	
CITRUS FRUITS		
Citrus fruits are produced by trees of the *Rutaceae* family and are characterized by aromatic oily peel, globular form and interior segments of juice-filled vesicles. The fruit is fully exposed to pesticides during the growing season. The fruit pulp may be consumed in succulent form and as a beverage. The entire fruit may be used for preserving.		
FRUITING VEGETABLES - INEDIBLE PEEL		

<table>
<tr><td colspan="2">Fruiting vegetables - inedible peel:</td><td rowspan="2">Whole commodity after removal of stems.</td></tr>
<tr><td>cantaloupe
melon
pumpkin</td><td>squash
watermelon
winter squash</td></tr>
<tr><td colspan="3">CITRUS FRUITS</td></tr>
<tr><td colspan="2">Citrus fruits are produced by trees of the Rutaceae family and are characterized by aromatic oily peel, globular form and interior segments of juice-filled vesicles. The fruit is fully exposed to pesticides during the growing season. The fruit pulp may be consumed in succulent form and as a beverage. The entire fruit may be used for preserving.</td><td></td></tr>
<tr><td colspan="2">Citrus fruits:</td><td>Whole commodity.</td></tr>
<tr><td colspan="3">POME FRUITS</td></tr>
<tr><td colspan="2">Pome fruits are produced by trees related to the genus Pyrus of the rose family (Rosaceae). They are characterized by fleshy tissue surrounding a core consisting of parchment-like carpels enclosing the seed. The entire fruit, except the core, may be consumed in the succulent form or after processing.</td><td></td></tr>
<tr><td colspan="2">Pome fruits:</td><td rowspan="2">Whole commodity after removal of stems.</td></tr>
<tr><td>apple
pear</td><td>quince</td></tr>
<tr><td colspan="3">STONE FRUITS</td></tr>
<tr><td colspan="2">Stone fruits are produced by trees related to the genus Prunus of the rose family (Rosaceae) characterized by fleshy tissue surrounding a single hard-shelled seed. The entire fruit, except seed, may be consumed in a succulent or processed form.</td><td></td></tr>
<tr><td colspan="2">Stone fruits:</td><td rowspan="2">Whole commodity after removal of stems and stones but the residue calculated and expressed on the whole commodity without stem.</td></tr>
<tr><td>apricots
cherries
sour cherries
sweet cherries</td><td>nectarines
peaches
plums</td></tr>
<tr><td colspan="3">SMALL FRUITS AND BERRIES</td></tr>
<tr><td colspan="2">Small fruits and berries are derived from a variety of plants whose fruit is characterized by a high surface-weight ratio. The entire fruit, often including seed, may be consumed in a succulent or processed form.</td><td></td></tr>
<tr><td colspan="2">Small fruits and berries:</td><td rowspan="2">Whole commodity after removal of caps and stems. Currants: fruit with</td></tr>
<tr><td>blackberries</td><td>gooseberries</td></tr>
</table>

blueberries boysenberries cranberries currants dewberries	grapes loganberries raspberries strawberries	stems.
ASSORTED FRUITS - EDIBLE PEEL		
Assorted fruits - edible peel are derived from the immature or mature fruits of a variety of plants, usually shrubs or trees from tropical or subtropical regions. The whole fruit may be consumed in a succulent or processed form.		
Assorted fruits - edible peel:		Dates and olives: whole commodity after removal of stems and stones but residue calculated and expressed on the whole fruit. Figs: Whole commodity.
dates figs	olives	
ASSORTED FRUITS - INEDIBLE PEEL		
Assorted fruits - inedible peel are derived from the immature or mature fruits of different kinds of plants, usually shrubs or trees from tropical or subtropical regions. Edible portion is protected by skin, peel or husk. Fruit may be consumed in a fresh or processed form.		
Assorted fruits - inedible peel:		Whole commodity unless qualified. Pineapples: after removal of crown. Avocado and mangoes: whole commodity after removal of stone but calculated on whole fruit. Bananas: after removal of crown tissue and stalks.
avocados bananas guavas kiwi fruit	mangoes papayas passion fruits pineapples	
CEREAL GRAINS		
Cereal grains are derived from the clusters of starchy seeds produced by a variety of plants primarily of the grass family (*Poaceae*). Husks are removed before consumption.		
Cereal grains:		Whole commodity. Fresh corn and sweet corn: kernels plus cob without husk.
barley maize oats rice	rye sorghum sweet corn wheat	
STALK AND STEM CROPS		
Stalk and stem crops are various kinds of plants, mostly of the grass family (*Poaceae*) cultivated extensively as animal feed and for the production of sugar. Stems and stalks used for animal feeds are consumed as succulent		

forage, silage, or as dried fodder or hay. Sugar crops are processed.		
Stalk and stem crops:		Whole commodity.
barley fodder and straw grass fodders	maize fodder sorghum fodder	
LEGUME OILSEEDS		
Legume oilseeds are mature seeds from legumes cultivated for processing into edible vegetable oil or for direct use as human food.		
Legume oilseeds:		Whole kernel after removal of shell.
peanuts		
LEGUME ANIMAL FEEDS		
Legume animal feeds are various species of legumes used for animal forage, grazing, fodder, hay or silage with or without seed. Legume animal feeds are consumed as succulent forage or as dried fodder or hay.		
Legume and animal feeds:		Whole commodity.
alfalfa fodder bean fodder clover fodder	peanut fodder pea fodder soybean fodder	
TREE NUTS		
Tree nuts are the seeds of a variety of trees and shrubs which are characterized by a hard, inedible shell enclosing an oil seed. The edible portion of the nut is consumed in succulent, dried or processed form.		
Tree nuts:		Whole commodity after removal of shell. Chestnuts: whole in skin.
almonds chestnuts filberts	macadamia nuts pecans walnuts	
OILSEED		
Oilseed consists of the seed from a variety of plants used in the production of edible vegetable oils. Some important vegetable oilseeds are by-products of fiber or fruit crops.		
Oilseed:		Whole commodity.
cottonseed linseed rapeseed	Safflower seed sunflower seed	
TROPICAL SEEDS		
Tropical seeds consist of the seeds from several tropical and semitropical trees and shrubs mostly used in the production of beverages and		

confections. Tropical seeds are consumed after processing.		
Tropical seeds:		Whole commodity.
cacao beans	coffee beans	
HERBS		
Herbs consist of leaves, stems and roots from a variety of herbaceous plants used in relatively small amounts to flavor other foods. They are consumed in succulent or dried form as components of other foods.		
Herbs:		Whole commodity.
SPICES		
Spices consist of aromatic seeds, roots, fruits and berries from a variety of plants used in relatively small amounts to flavor other foods. They are consumed primarily in the dried form as components of other foods.		
Spices:		Whole commodity.
TEAS		
Teas are derived from the leaves of several plants, but principally *Camellia sinensis.* They are used in the preparation of infusions for consumption as stimulating beverages. They are consumed as extracts of the dried or processed product.		
Teas:		Whole commodity.

Appendix-C

(C) GUIDELINES FOR PERSISTENCE AND RESIDUE ANALYTICAL STUDIES

Residue analytical method is examined in the laboratory considering its validation criteria. The method should be suitable for the purpose it is used. In order to justify the suitability of the method, various validation steps are required to be performed, e.g., analytical recoveries, impact of matrix interference, limit of quantitation(LOQ), repeatability and reproducibility. It is important to note that the residue analytical method should be able to determine the parent compound as well as the metabolite(s) as per the residue definition used for dietary risk assessment. In such cases, different analytical methods may be required to perform as the specific method sometimes cannot cover the parent compound as well as metabolite(s).

Method validation is a mandatory requirement for the laboratories when methods used are;

1) non-standard methods

2) designed/developed by laboratory

3) modified (standard methods) or amplified by the laboratory

4) adopted by addition of new analyte(s) or matrix outside the scope of the existing validated method

When a laboratory wants to use a reference method that has been extensively validated (e.g., AOAC, Codex Alimentarius, etc.) is required to confirm that it can properly operate standard method before conducting the reference method. This confirmation can be via "verification" of certain key performance characteristics of the standard method. Thus method verification is a partial validation and hence is less extensive.

The method must be validated to assess linearity, recovery (as a measure of trueness), RSDR (as a measure of precision), limit of detection (LOD) and of quantitation (LOQ), and selectivity (proven by identification-confirmation procedures). Additionally, the effect of each matrix on quantitation should be evaluated and the uncertainty of results must also be estimated.

- **Linearity:** The line generated for each analyte at ≥5 concentration levels should be provided, together with the slope, the intercept and correlation co-efficient data. The requirement for a calibration line to be used for quantitation is the correlation coefficient (r) to be >0.98 over the working range.
- **Trueness:** A minimum of 5 replicates is required to check the recovery at the targeted LOQ or reporting level (RL) of the method, and at least one other higher level, for example, 2-10 times the targeted LOQ or the MRL. Where the residue definition includes more than one analyte, then the method should be validated for all analytes included in the residue definition if compliance with maximum residue levels (MRLs) is to be given in the report. Acceptable mean recoveries are usually those within the range 70–120%. However, in certain cases and typically with multi-residue methods, recoveries outside this range

are accepted. These are cases, where recovery is low but consistent, i.e. demonstrating acceptable precision (RSDr values ≤20%). A correction factor for the recovery should be used in the report for these analytes. Additionally, a proficiency test should be sought for these analytes to verify the correctness of the procedure followed.

- **Precision:** A minimum of 5 replicates is required to check the precision, at the targeted LOQ or reporting level (RL) of the method, and at least one other higher level, for example, 2-10 times the targeted LOQ or the MRL. Repeatability RSDr values determined from the validation experiments should be ≤ 20%, while within-laboratory reproducibility (RSDR), which may be determined from ongoing QC-data in routine analyses, should be ≤ 25%. Contributions arising from sample heterogeneity should be excluded when evaluating precision of the method.

- **Limit of Quantification(LOQ):** By long-standing definition among analytical chemists, the LOQ is the concentration at which the average signal/noise ratio (S/N) equals 10 in the analysis. The LOQ in practice can only be estimated because precise determination of the actual LOQ requires many analyses of spiked samples and matrix blanks but the LOQ can change day-to-day due to the performance state of the instrument, among many other factors. Some validation guidelines require that the LOQ be verified to meet method performance criteria via spiking experiments at the LOQ, however day-to-day variations in LOQ tend to force the analyst to greatly over-estimate the actual method LOQ, which can be difficult to implement the strict definition of the LOQ (S/N = 10). Thus spiking at the Lowest Validated Level (LVL) is the more descriptive and proper approach. Furthermore, quantification of analytes should not be made below the lowest validated level (LVL) in the same analytical sequence. The S/N at the lowest calibrated level (LCL) must be ≥10 (conc. ≥ LOQ), which can be set as a system suitability check required for each analytical sequence. A quality control matrix spike can also be included in each sequence to verify that the reporting limit is achieved in the analysis (an action level that is typically >the LCL). In essence, the point of the validation is not to determine the LOQ, but to demonstrate that the lowest reported concentration is meeting the need for the analysis.

- **Selectivity:** Response in reagent blank and blank control samples should be <30% of the LOQ or the reporting level response. The following Identification criteria should be met:
  - The retention time of the analyte in the extract should correspond to that of the calibration standard (may need to be matrix-matched), with a tolerance of ±0.1min, for both gas chromatography and liquid chromatography. Larger retention time deviations are acceptable, based on experimental data of the laboratory, as for example RT tolerance ≤ 2s, with s the standard deviation of the retention time over a certain time period.
  - The peak shape of the analyte in the extract should match with that of the calibration standard, e.g. the peak width, at half of its height, must be within ±10 % of the original width of the analyte peak.
  - The chromatographic profile of the isomers of an analyte may provide helpful evidence.

Co-chromatography may be used for providing evidence of analyte identity, however it is not a fully confirmatory technique, as it is based on the retention time criterion only. According to this technique the sample extract is fortified by addition of an appropriate amount of calibration solution. The amount of analyte added must be similar to the amount of the analyte found in the sample extract.

In order not to reject the assumption that the suspect peak is the analyte peak, only the height of the analyte peak and the internal standard peak should be enhanced after taking into account both the amount added and the dilution of the extract. The peak width, at half of its height, must be within ±10 % of the original width of the analyte peak or the internal standard peak of the unfortified sample extracts.

- If confirmation is not based on a MS technique, the use of a different chromatographic separation is required that will also satisfy the above mentioned criteria. For example a different chromatographic separation could be the use of a LC system in the case that the initial system was a GC system. In the case that only a GC system is available, then a different chromatographic separation could be at least the use of a column of significantly different polarity.

- **Selectivity requirements for Mass Spectrometry:** Selective ion chromatograms should have peaks exceeding S/N 3:1, of similar retention time, peak shape and response ratio to those obtained from a calibration standard analysed at comparable concentration in the same batch. Chromatographic peaks from different selective ions for the same analyte must overlap with each other. The requirements for different types of MS detectors are given in the following table:

MS mode	**Single MS (unit mass resolution)**	**Single MS of high mass accuracy**	**MS/MS**
Typical system(examples)	Quadrupole, ion trap, time-of-flight(TOF)	High resolution: Q-TOF, Orbitrap, FTMS, magnetic sector	Triple quadrupole, ion trap, hybrid MS(e.g., Q-TOF, Q-trap)
Acquisition	Full scan, Limited m/z range Selected ion monitoring(SIM)	Full scan Limited m/z range, SIM	Selected/multiple reaction monitoring(SRM/MRM), full scan product-ion spectra
Requirements for ions	≥ 3 ions	≥ 2 ions with mass accuracy < 5 ppm.	≥ 2 product ions

Ion ratio	Within ±30%(relative) of average of calibration standards from same sequence.
Other	S/N ≥ 3, Analyte peaks in the extracted ion chromatograms must fully overlap.

- **Matrix effects:** Matrix effects are known to occur frequently in both GC and LC methods and should be assessed at the initial method validation stage. The analytes that require use of calibration standards in solvent and the analytes that require use of calibration standards in matrix should be clearly identified during this process. Comparison of response arising from solvent standards and from matrix-matched standards is used for this purpose. A maximum 20% difference is considered as acceptable for using solvent standards as calibration standards. In a different case matrix matched calibration is required.

For adoption of the validated method:

a) Calibration function: Test the response function of the analyte at ≥ 3 analyte levels at LOQ and 2 and 3 times MRL or LOQ (if MRL is at LOQ), plus blank. For non-linear response, determine response curve at 7 ≥ levels and ≥ 3 replicates.

b) Matrix effect: Test the matrix effect with the same or representative matrices.

c) Accuracy & Precision: Analyse analyte/matrix combinations at ≥ 5 replicates spiked at LOQ (or MRL) and 2 X LOQ (or MRL).

d) Specificity and selectivity: Check performance characteristics of detectors used and compare them with those specified in the method. Check response of a blank of the commodity. Make it sure that the measured response in the extract is solely due to the analyte. Response in reagent blank and blank control samples should be <30% of the LOQ or the reporting level response.

References:

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